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(54) **PROCESS AND APPARATUS FOR THE CONTINUOUS PRODUCTION OF ABSORBENT BODIES.**

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**EP-A- 0 105 429**  
**EP-A- 0 149 155**  
**CH-A- 355 255**  
**GB-A- 115 918**

**F. SÄNGER et al.: "Was der Walzwerker von seiner Arbeit wissen muss", part 1,2,3, 2nd edition, 1986, Verlag Stahleisen, (Düsseldorf, DE), pages 54-57, 114-115, 122-125, 146-147 94-99 see part 1, pages 54-57; pages 114-115; pages 122-124; page 147; part 2, pages 95 - 98**

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## Description

The invention relates to a process and apparatus according to the pre-characterizing clauses of Claims 1 and 20.

A process and an apparatus of the abovementioned generic type are known from CH-A-355,255. In this, a wad roll is folded on itself in the longitudinal direction and surrounded by a sheathing band, the mutually overlapping longitudinal sides of which are connected to one another by means of heated press rollers. The fibre rod is then severed into individual length portions which are thereupon pressed intermittently in a press to form tampons. The sheathing band at the same time forms the recovery band for the tampon.

A process and an apparatus are known from US-A-3,523,535, and in these an air-placed wood-pulp layer is applied to a nonwoven sheathing band of viscose fibres and is fed between two conveyor belts to a nozzle-like die which gives the rod of material a circular cross-section. The rod of material is thereafter guided over a table, above which are arranged a glue applicator device for closing the sheathing band and two press rollers which exert slight pressure on the rod of material in order to stabilize its form, before the rod is subsequently cut into individual tampon lengths.

The object on which the invention is based is to improve the process and apparatus for the continuous production of absorbent bodies according to the pre-characterizing clauses of Patent Claims 1 and 20, in such a way as to obtain a high-speed process and a corresponding apparatus for the production of those absorbent bodies which are suitable particularly as tampons for feminine hygiene and which, whilst preserving essential properties of known tampons, have an increased stability or buckling resistance.

The invention achieves this object by means of the features mentioned in the characterizing clauses of Patent Claims 1 and 20.

As a result of the invention, the properties of the absorbent bodies can easily be matched to their particular intended use. At the same time, it is guaranteed that the mass production of the absorbent bodies will be extremely economical, because it is continuous. The range of variation of the process according to the invention and of the apparatus according to the invention makes it possible, for instance, to apply a sheathing band to the absorbent body and to produce absorbent bodies with or without a different number of longitudinal grooves which, when the absorbent bodies are used as tampons, contribute considerably to increasing the stability and absorption rate of such tampons. These advantages are achieved even though all the operations of processing the fibre material take

place continuously, that is to say at no time in the process is there any interruption in the work cycle or any intermittent processing.

The invention is explained in detail below by reference to the diagrammatic drawing of an exemplary embodiment of the apparatus according to the invention. In the drawing:

- 5                    Fig. 1            shows a partially diagrammatic perspective view of the apparatus according to the invention with folding, sheathing-band application, press and severing stations;
- 10                  Fig. 2            shows a top view of the folding pattern of the web of fibre material;
- 15                  Fig. 3            shows a cross-section along the line 3 - 3 of Fig. 2, showing the first folding of the web of fibre material;
- Fig. 4            shows a cross-section along the line 4 - 4 of Fig. 2, showing the second folding of the web of fibre material;
- 20                  Fig. 5            shows a cross-section along the line 5 - 5 of Fig. 2, showing the third folding of the web of fibre material;
- Fig. 6            shows a cross-section along the line 6 - 6 of Fig. 2, showing the folded web of fibre material after a side edge has been laid round onto the top side of the folded part of the web of fibre material;
- 25                  Fig. 7            shows a perspective front view of the sheathing-band application station;
- 30                  Fig. 8            shows a perspective front view of the press station;
- Fig. 9            shows a perspective rear view of a guide positioned between mutually adjacent pairs of rollers in the press station;
- 35                  Fig.10           shows a top view of the guide according to Fig. 9;
- 40                  Fig.11           shows a side view of the guide;
- Fig.12           shows a front view of the guide;
- Fig.13           shows a cross-section along the line 13 - 13 of Fig. 10;
- 45                  Fig. 14           shows a cross-section along the line 14 - 14 of Fig. 11;
- Fig. 15           shows a cross-section along the line 15 - 15 of Fig. 8;
- Fig.16           shows a cross-section along the line 16 - 16 of Fig. 8;
- 50                  Fig.17           shows a cross-section along the line 17 - 17 of Fig. 8;
- Fig.18           shows a view of the fleece rod when it is subjected to compression, the rollers and guides having been removed for the sake of a clearer illustration;
- 55                  Fig.19           shows a perspective view of a finished absorbent body, and

Fig.20 shows a perspective view of a device for the shaping the front and rear ends of an absorbent body.

Fig. 1 illustrates an apparatus for the continuous production of absorbent bodies 30, in this particular case of tampons 32 for feminine hygiene (Fig. 19), which are equipped at their front end with a round dome 35, on the circumference with four longitudinal grooves 31 and at their rear end 34 with a depression 33 and with a recovery band 36, the ends of which are connected by means of a knot 37.

According to Fig. 1, the apparatus consists of a stock roll 38 for a web of fibre material 40 which is processed continuously in successively arranged stations, namely a folding station A, a sheathing-band application station B, a press station C and a severing station D.

#### Folding station

It is evident from Fig. 1 that a stationary guide plate 42 for the endless web of fibre material 40 is arranged behind the stock roll 38 in the direction of advance x of the web of fibre material 40. Mounted at a distance above the guide plate 42 is an endless conveyor belt 44 which is preferably vertically adjustable and which, by means of a frictional connection, ensures the continuous transport of the web of fibre material 40 in the direction of the arrow x. In contrast to the embodiment illustrated, instead of the guide plate 42 there can equally well be an endless conveyor belt, in which case at least one of the conveyor belts is drivable. These devices, like the stations described below and the devices belonging to these, are arranged on a stand, of which only stand parts 46 and 48 are indicated. Furthermore, it goes without saying that the guide plate 42 extends at least over a substantial part of the underside of the folding station A and for the sake of clarity is merely indicated in Fig. 1.

Behind the conveyor belt 44 in the direction of advance x, a lead plate 50 is arranged above the web of fibre material 40, and behind it is a folding plate 52 followed by a rotatable folding disc 54. By means of this first folding plate 52, according to Fig. 2 the longitudinal side 56 on the right in the direction of movement x undergoes a first folding operation I. In this, the longitudinal side 56 of the web of fibre material 40 on the right in the direction of movement x is folded round upwards in the direction of the arrow a in parallel with the longitudinal direction of the web of fibre material 40 and laid onto the top side of the web of fibre material 40. It is evident from Figs. 2 and 3 that, after the folding operation I, the right longitudinal edge 58 assumes a greater distance from the left longitudi-

nal edge 60 than the longitudinal mid-axis of the web of fibre material 40. In the present exemplary embodiment, the web of fibre material 40 has a width of 25 cm. In this instance, the width of the first fold 62 appropriately amounts to 9 cm. The dimensions of the web of fibre material 40 can differ according to the intended use of the particular absorbent bodies produced. As a rule, however, the width of the web of fibre material 40 will be in the range between 15 and 40 cm.

It is clear from further reference to Figs. 1, 2 and 4 that the first folding operation I is followed by a second folding operation II which is once again carried out by means of suitable folding plates and folding rollers, although these are not shown in detail for the sake of clarity in the drawing. This folding operation II involves folding the right longitudinal edge formed by the fold 62 in the direction of the arrow b onto the folded-round right longitudinal side 56 about a longitudinal fold 64 and onto the top side of the longitudinal side 56 and laying it down approximately over the middle third of the width of the longitudinal side 56. This second folding takes place over a width of approximately 2 cm in the case of the abovementioned width of the web of fibre material 40.

As is evident from Figs. 1, 2, 4 and 5, there follows a folding operation III, in which the four-layered stack 66 is folded round in the direction of the arrow c onto the still uncovered part 68 of the right longitudinal side 56 on the left according to Fig. 5, as seen in the direction of movement x of the web of fibre material 40, so that the web of fibre material 40 is now limited in the direction of movement x on its right side by a six-layered stack 689. This folding operation III extends over approximately 3.5 cm in the case of the abovementioned width of the web of fibre material 40.

The left longitudinal side 70 of the web of fibre material 40 still remaining according to Fig. 5 is now laid, as seen in the direction of movement x of the web of fibre material 40, in the opposite direction according to the arrow d in Figs. 1, 2 and 6 round the left edge of the six-layered stack 69 and onto its top side, thereby forming as a result of this folding operation IV a seven-layered web of fibre material 72 which is completely surrounded by the remaining left longitudinal side 70 of the web of fibre material 40. At the end of the folding station A there are profile rollers which give the seven-layered web of fibre material 72 the round cross-section according to Fig. 6. Press rollers of this type are known and are therefore not shown. The left longitudinal side 70 of the web of fibre material 40 has a width of approximately 6 cm before the execution of the folding operation IV. Of course, another method of longitudinal folding or layering of the web of fibre material 40 can also be carried

out according to the particular intended use of the absorbent body.

#### Sheathing-band application station

It can be seen from Fig. 1 that the sheathing-band application station B has a stock roll 80 for a sheathing band 82 in the region of the completely layered and rounded web of fibre material 72. The sheathing band 82 is permeable to liquid, the fibre material of the sheathing band preferably having a water-repellant finish and containing at least partially thermoplastic constituents. Advantageously, the sheathing band 82 consists of a nonwoven fibre layer having thermoplastic constituents. This sheathing band 82 is made wider than the circumference of the web of fibre material 72. A lead roller 84 is arranged transversely relative to the direction of movement x behind the stock roll 80 at a short distance below the web of fibre material 72. According to Fig. 7, the function of this lead roller 84 is to guide the sheathing band 82, fed in the direction of the arrow d from the stock roll 80, in the direction of the arrow e under a guide tube 86 and into a direction parallel to the web of fibre material 72.

The guide tube 86 is arranged downstream of the lead roller 84 for the web of fibre material 72. Its purpose is to maintain the round cross-section of the web of fibre material 72. The inner wall of the guide tube 86 is accordingly of essentially circular-cylindrical form.

On the underside, the guide tube 86 is equipped with a longitudinal slot 88 which can be seen in Fig. 7. Arranged on the underside of the guide tube 86 is an endless conveyor belt 90 which is made narrower than the longitudinal slot 88. It is thereby possible to guide the upper strand 92 of the conveyor belt 90 in the region of the longitudinal slot 88 of the guide tube 86 by means of a support plate 91, in such a way that the web of fibre material 72 is taken up as a result of a frictional connection. The endless conveyor belt 90 is guided in the conventional way round a driving roller 94 and a deflecting roller 96 and is driven in the direction of the arrow f, so that the upper strand 92 can be driven in the direction of movement x of the web of fibre material 72 at a speed which corresponds to the conveying speed of the web of fibre material 72.

The sheathing band 82 is guided by means of the lead roller 84 between the top side of the upper strand 92 of the conveyor belt 90 and the underside of the web of fibre material 72 in the region of the longitudinal slot 88 and is taken up as a result of the frictional connection occurring thereby between the upper strand 92 and the web of fibre material 72.

The guide tube 86 is equipped on the left and right sides in the direction of movement x of the web of fibre material 72 with respective introduction slots 98, 100 which are formed by successively arranged segments 102, 104 and 106 of the guide tube 86. It is evident that the two introduction slots 98, 100 are offset in the axial direction of the guide tube 86. At the same time, the segment 104 is formed in a twisted manner, in such a way that the trailing edge 108 of the first segment 102 forming an acute angle with the core of the guide tube 86 and extending similarly to a helix assumes a shorter radial distance from the tube core than the leading edge 110 of the segment 104 likewise limiting the introduction slot 98.

In a similar way, the radius of that edge 112 of the segment 104 located at the rear in the direction of movement x is made smaller than the radius of the leading edge 114 of the rear segment 106 of the guide tube 86 likewise limiting the right introduction slot 100.

For the sake of clarity in the drawing, Fig. 7 does not show the sheathing band 82 in its full width which ensures that the sheathing band has left and right side tabs 116, 118 which are laid round the guide tube 86 upwardly by guide rollers known per se and therefore not shown and which slide along on this. However, Fig. 7 shows the left side tab 116 of the sheathing band 82, as it is being introduced into the left introduction slot 98 beyond the outer surface of the segment 102 in the direction of the arrow g and laid by means of the segment 104 onto the rounded, essentially cylindrical, surface of the web of fibre material 72. Similarly, the right side tab 118 of the sheathing band 82 is subsequently likewise laid in the direction of the arrow h over the outer face of the segment 104, through the right introduction slot 100 and onto the surface of the rounded web of fibre material 72 by means of the segment 106. At the same time, the outer longitudinal edge 124 of the right side tab 118 overlaps that longitudinal edge 126 of the left side tab 116 of the sheathing band 82 first laid onto the top side of the web of fibre 72.

Fig. 7 also shows that the guide tube 86, in the region of the rear segment 106, is likewise equipped on the top side with a middle longitudinal slot 120 for a closing device 122 which serves for connecting together the longitudinal edges 124, 126 of the side tabs 116, 118 of the sheathing band 82. In the present exemplary embodiment, the closing device 122 consists of a hot-sealing roller 128 which is made narrower than the longitudinal slot 120 and which consequently bears through the longitudinal slot on the mutually overlapping edges 124, 126 and seals these to one another as a result of the softening of thermoplastic

constituents of the sheathing band 82. The hot-sealing roller 128 can be heated in a way known per se by means of electrical resistance heating and can be driven in the direction of rotation of the arrow i at the conveying speed of the rounded sheathed web of fibre material 130 which leaves the guide tube 86 at its end.

#### Press station

Referring to Figs. 1 and 8, the press station C consists of a feed tube 139 and of a roller frame 140 composed of a plurality of oppositely drivable pairs of rollers 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, and 164. As shown in Figs. 1 and 8, the pairs of rollers are successively arranged respectively offset relative to one another at 90°. The pairs of rollers 142, 146, 150, 154, 158 and 162 are respectively arranged in a vertical plane horizontally and in parallel above one another. In contrast, the pairs of rollers 144, 148, 152, 156, 160 and 164 are respectively aligned vertically and parallel to one another in vertical planes. There is the least possible distance between the said successive pairs of rollers.

The roller frame 140 is composed of three groups of pairs of rollers which differ from one another in that the nip of the first group of pairs of press rollers 142, 144, 146, and 148 which is formed by the free rolling cross-section is reduced successively in steps more pronouncedly than the nip of the following second group of pairs of press rollers 150, 152, 154 and 156 which is formed by the free rolling cross-section. The third group is formed by pairs of smoothing rollers 158, 160, 162 and 164 which each have the same nip size. It is clear that, for example, both the number and the circumference of the groups of rollers can be changed according to the type of absorption body to be produced.

Fig. 15 illustrates in a partially cutaway representation a cross-section through the horizontally arranged pair of press rollers 146, in front of which in the upstream direction the pair of press rollers 144 offset at 90° and rotatable about vertical shafts can be seen. It is evident that the roller profiles 166, 168, symmetrical relative to the bisecting plane z-z of the nip 165, of the upper roller 170 and of the lower roller 172 of the pair of press rollers 146 are made in the form of a three-centre curve and, together with a profile bottom 174, 176 of the vertical roller 178, on the left in the conveying direction x, and of the right vertical roller 180 of the pair of press rollers 144, form a free rolling cross-section which corresponds to an equilateral octagon symmetrical relative to the bisecting plane z-z of the nip 165 of the rollers 170, 172. Because the pairs of press rollers 144 and 146 shown in Fig.

15 are arranged in direct succession in the conveying direction x, first the rollers 178, 180 of the vertical pair of press rollers 144 continuously act diametrically on the web of fibre material in the horizontal direction, in order to roll from the latter a fleece rod 240, the cross-section of which is likewise shown in Fig. 15. Subsequently, the fleece rod 240 is subjected diametrically in the vertical direction to a rolling pressure by means of the rollers 170, 172 of the horizontal pair of press rollers 146. Because the successive pairs of press rollers are arranged offset at 90°, this prevents the formation of a longitudinal rolling burr on the fleece rod 240 and at the same time reduces the cross-section of the latter in steps in each case.

As also emerges from Fig. 15, the mutually-parallel profile bottoms 166, 168 of the horizontal pair of press rollers 146 and the profile bottoms 174, 176 of the vertical pair of press rollers 144 are each equipped in the centre with a circumferential rib 182, 184 and 186, 188. The profile of the circumferential ribs is triangular and tapers outwards. If appropriate, however, the circumferential rollers can also have a different profile, for example an angular or round profile. The circumferential ribs of each pair of press rollers have the same dimensions, so that the fleece rod 190 sheathed in the sheathing band 82 can be equipped with corresponding approximately V-shaped longitudinal grooves 192, 194 and 196, 198 at locations on its circumference which are offset at 90°.

Fig. 16 shows the pair of press rollers 154 with the horizontal upper roller 200 and the lower roller 202 located at a distance below it and in parallel in a vertical plane. The vertical rollers 204 and 206 of the pair of press rollers 152 preceding it in the conveying direction x of the fleece rod 190 can be seen. It is evident from Fig. 16 that the free rolling cross-section formed by the two successive pairs of rollers 152 and 154 corresponds once again to an approximately equilateral octagon. However, this free octagonal rolling cross-section is made substantially smaller in comparison with that described with reference to Fig. 15. Furthermore, Fig. 16 shows that, for the further deepening of the longitudinal grooves 192, 194, 196 and 198 of Fig. 15, the circumferential ribs 208, 210 of the upper roller 200 and of the lower roller 202 and the circumferential ribs 212 and 214 of the preceding vertical rollers 204, 206 have a foot of approximately equal width. However, the circumferential ribs 212, 214, with their profile likewise tapering outwards, project so far radially outwards beyond mid-height of the profile depth of each roller in the mid-plane of the profile of the latter that sharply pronounced V-shaped longitudinal grooves 216, 218, 220 and 222 can be formed in the fleece rod 240 of now greatly compressed cross-section and in its sheathing

band 82.

A smaller reduction of the cross-section of the fleece rod 240 takes place in the second group formed by the pairs of press rollers 150, 152, 154 and 156. In the present exemplary embodiment, this reduction amounts in each case to approximately 0.5 mm in the second group of press rollers in comparison with 1 mm in the first group. The fleece rod 240 is thereby compressed to an even smaller cross-section which has been reduced to the final cross-section of the fleece rod 240 shown in Fig. 17 by means of the preceding pair of press rollers 156 with the roller 224, on the left in the conveying direction x, and the right roller 226 of the vertical pair of press rollers 160 of the second group.

The horizontal upper roller 228 and lower roller 230 of the pair of rollers 162, like the following pair of rollers 164, are designed as smoothing or calibrating rollers, of which the nip is constant and serves for stabilizing the form or cross-section of the fleece rod 240 and smoothing the surface of the latter.

The profile of the pairs of smoothing rollers 228, 230 and 224, 226 in Fig. 17 differs from the profile shown in Figs. 15 and 16 by having a basic form 232 essentially in the form of an arc of a circle. The middle circumferential rib 234 of tapered profile of all four rollers mentioned projects radially to approximately the height of the cylindrical diameter of these rollers. For the sake of simplicity, in this particular case all the circumferential ribs of the said smoothing rollers are given the reference symbol 234 in Fig. 17. By means of the nip described, the fleece rod 240 acquires a cross-sectional form, in which pronounced longitudinal grooves 236 lying diametrically opposite one another in pairs and arranged at equal angular intervals of 90° are formed in the fleece rod 240 by the circumferential ribs 234. Here too, for the sake of simplicity, the longitudinal grooves 236 of the fleece rod 240 are given only the single reference symbol 236. In contrast to the exemplary embodiment described and according to the particular intended use of the absorbent bodies, it is possible to produce the fleece rod 240 without longitudinal grooves or to equip it with a larger number of longitudinal grooves which should preferably always be distributed uniformly over the circumference of the fleece rod 240. Where the production of tampons is concerned, the arrangement of longitudinal grooves is advantageous because it leads to a partial compression of the fibre material in the longitudinal mid-axis of the fleece rod 240, this resulting in a stability or buckling resistance of the finished tampon which exceeds the stability and buckling resistance of known tampons. It can be assumed that this advantage is

related to the continuous stepped press-rolling of the fleece rod 240 in the roller frame 140 described.

The horizontal pairs of smoothing rollers 158, 162 in Fig. 8 are followed by the vertically arranged pairs of smoothing rollers 160, 164 with the same nip as the pair of smoothing rollers 158, so that the fleece rod 240 is smoothed over its entire circumference and its cross-sectional form stabilized.

A control device known per se and therefore not shown serves for maintaining the same mean circumferential speed of all the press and smoothing rollers arranged in the roller frame 140.

The shaping and stabilization of the form of the fleece rod can be assisted, if appropriate, by preferably equipping the cylindrical circumferential portions of the roller profiles with a rubber or plastic coating, in order to increase the friction relative to the fleece rod.

Furthermore, where appropriate, some or all of the pairs of press and/or smoothing rollers can be heated, so that the shaping of the fleece rod 240 is accompanied by a certain ironing effect which increases the dimensional stability of the fleece rod. At the same time, the nip of the successively arranged pairs of press rollers of the first and second group can be calculated so that the fleece rod 240 is rolled down only approximately to the final cross-section of the desired absorbent body. However, at least where the production of tampons for feminine hygiene is concerned, it is recommended that the fleece rod 240 be rolled down considerably beyond the final cross-section of the tampon to a smaller cross-section, because the fibres of the fleece rod have a natural elasticity which causes the cross-section of the finish-pressed tampon to expand. Consequently, it is possible to calculate the reduction of the final cross-section of the fleece rod in such a way that the tampon, after it has been finished, expands to a final cross-section which corresponds to the physiological preconditions for its use.

Moreover, it can be seen from Fig. 8 that guides in the form of guide surrounds 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272 and 274 fill essentially completely the interspaces between the successive pairs of press and smoothing rollers 142 to 164 for the positive guidance of the fleece rod 240. In accordance with the 90° offset of the successive pairs of press and smoothing rollers, the said guide surrounds 250 to 274 are also successively arranged offset respectively at 90° relative to one another in the conveying direction x of the fleece rod 240. To allow this positive guidance of the fleece rod 240 within the roller frame 140, the clear entry cross-section of each guide surround is made smaller than the nip of the pair of press rollers preceding the guide surround,

whilst the clear cross-section of the exit end of each guide surround is larger than the nip of the pair of press rollers following the guide surround.

Referring to Figs. 9 and 12, the clear cross-section of the guide surrounds is essentially elliptic or oval. At the same time, the major axis 278 of the elliptic or oval cross-section of each guide surround between successive pairs of press rollers 142 to 160 is arranged parallel to the major axis of the particular pair of press rollers 142 to 162 preceding in relation to the conveying direction x of the fleece rod 240. Thus, the diametrical pressing of the fleece rod 240 by the pair of press rollers preceding each guide surround takes place in each case in the direction of the minor axis 280 of the essentially elliptic or oval cross-section of each guide surround (Fig. 12). The cross-section of the fleece rod 240 is at the same time shaped into an elliptic or oval form. The fleece rod 240 coming out of the respective pair of press rollers is received positively by the corresponding cross-section of each guide surround, the said cross-section narrowing in the conveying direction of the arrow x. The fleece rod 240 is fed to the following pair of press rollers by a guide surround narrowing towards its rear end so as to leave a cross-section which assists or prepares the reduction of the cross-section of the fleece rod by the following pair of rollers.

This cross-sectional reduction towards the rear or outlet end which is ensured at each guide surround is evident above all from Figs. 9, 11, 12, 13 and 14. Fig. 9 shows the guide surround 252 of those guide surrounds 252, 256, 260, 264 and 270 which are arranged respectively between a preceding horizontal pair of press rollers 142, 146, 150, 154, 158 and a vertical pair of press rollers 144, 148, 152, 156, 160 located behind the guide surround. The guide surround 252 in Fig. 9 is arranged behind the pair of press rollers 142 represented by dot- and dash-lines and in front of the following vertical pair of press rollers 144, as seen in the conveying direction of the fleece rod (not shown) indicated by the arrow x and fills the interspace between these two pairs of press rollers essentially completely. The front side is equipped with flanks 282, 284 which correspond to the horizontal pair of press rollers 142 and are in the form of a cylinder cutout and converge in a funnel-shaped manner and into which the upper and lower rollers 286, 288 engage rotatably. Two lateral jaws 290 and 292 project into the interspace formed by the upper roller 286 and the lower roller 288 of the horizontal pair of press rollers 142 and thereby extend the conical guide face 294 of the guide surround 252. The conically narrowing guide face 294 is continued in the conveying direction of the arrow x by a tapering upper guide rib 296 and a lower, identically tapering guide rib 298 which are

limited laterally by the flanks 300, 302 and 304, 306 tapering in a funnel-shaped manner. These flanks are matched to the circumferential faces of the vertical rollers 308, 310 of the pair of press rollers 144, the front ends 312, 314 of the guide ribs 296, 298 coming close to the narrowest point of the nip of these vertical rollers 308, 310.

For clarification, Figs. 11, 12, 13 and 14 show on an exaggerated scale the reduction of the clear cross-section 276 of the guide surround 252 in the direction of the minor axis 280 of the essentially elliptical or oval cross-section of the guide surround. The U-shaped cross-section 320 formed by the lateral jaws 290, 292 and the guide ribs 296, 298, open in the direction of the arrow x in Fig. 11 and intended for the roller profiles of the vertical press rollers 308, 310, narrows forwards, so that the inner front corners 316, 318 of the guide ribs 296, 298, limiting the elliptic guide face 294 tapering in a nozzle-like manner are arranged at a smaller distance from one another than a length portion 322, 324 of the guide ribs 296, 298 which is located behind them.

Consequently, the inner front corners 314, 316 engage into the upper and lower longitudinal groove 192, 194 of the fleece rod 240 (Fig. 15) and thereby form an axial guide for the fleece rod 240. However, the longitudinal grooves of the fleece rod 240 which are shown in Figs. 15 to 17 are not a precondition for this shape of the guide surrounds. On the contrary, this shape of the guide surrounds serves for positively guiding and compacting the fleece rod 240 in that diametrical direction extending perpendicularly relative to the pressing direction, to which the fleece rod 240 is exposed by the following vertical pair of press rollers 144, namely in the horizontal direction of the major axis 278 of the elliptical cross-section of the guide surround 252 in Fig. 12. The guide ribs 296, 298 of the guide surround 252 in Fig. 9 therefore each exert the particular radial pressing force on the fleece rod 240. Moreover, this applies, albeit to a smaller extent, to the guide face 294 in the region of the lateral jaws 290, 292. At the same time, the guide face 294 widens conically in the region of the entry cross-section, to such an extent that the fleece rod 240 can easily be moved into the guide surround 252, as can be seen in Fig. 14. It is therefore clear that an essentially complete positive guidance of the fleece rod 240, allowing an unimpeded conveyance of the fleece rod through the roller frame 140, is guaranteed over the entire length of the roller frame 140.

#### Severing station

The severing station D in Fig. 1 consists of at least two mutually oppositely drivable pairs of

pinching rollers 330, 332, which are offset at 90° and of which the first pair of pinching rollers 330 is arranged superposed horizontally and in parallel in a plane perpendicular relative to the direction of advance x, whilst the second pair of pinching rollers 332 is arranged vertically at a distance and mutually parallel in a plane perpendicular relative to the direction of advance. The pinching rollers of the two pairs of pinching rollers 330, 332 are each equipped with a pinching projection 334, 336 and 338, 340. The pinching projections 334, 336 reduce the cross-section between successive length portions of the fleece rod 240 corresponding approximately to the length of the tampon 32, with the exception of a thin axial connecting web (not shown). This connecting web is severed by the last pair of pinching rollers 332 of the severing station D, and, as a result of the relatively high circumferential speed of the pinching rollers 338, 340 corresponding to the conveying speed of the fleece rod 240, is ejected with relatively sharp axial impetus. While the absorbent body 30 is being pinched by the pairs of pinching rollers 330, 332, at the same time the front end 342 of the absorbent body 30 is preformed pyramidally, as can be seen from Fig. 20. In contrast, the rear end face of the absorbent body 30 already has a pyramidal recess.

When a sheathing band 82 is used, it is recommended that at least one pair of cutting rollers as a cutting device be arranged at the end and/or at the start of the severing station D, so that the sheathing band 82 surrounding the fleece rod 240 and/or the thin axial connecting web between successive portions of the fleece rod 240 can be severed. The cutting rollers are not shown because they are generally known in the art.

Figs. 1 and 20 show that the absorbent body 30, after being severed, is transferred into a take-up means 344 which is made narrower than the length of the absorbent body 30. For receiving the absorbent body 30, the take-up means 344 is equipped with a U-shaped transverse indentation 346 which is closed at the top by means of a take-up means lid 348 after the absorbent body 30 has been received. A plurality of take-up means 344 of this type are fastened to the outside of a endless conveying member 350 movable continuously in the direction of the arrow n and represented merely by dot- and dash- lines in Fig. 20, so that the take-up means 344 can continuously receive the absorbent bodies 30 ejected from the severing station D. The means for transferring the absorbent bodies into the take-up means belong to the state of the art and are therefore not shown.

Fig. 20 shows that, in parallel with the plane of movement of the endless conveying member 350, on both sides further endless conveying members 352 and 354 are arranged on each side of the

conveying member 350.

The conveying member 352 carries a plurality of dome-forming devices 356 which are move synchronously with the take-up means 344 in the direction of the arrow n. According to Fig. 20, each of the dome-forming devices 356 consists of a U-shaped part 358, the legs 360, 362 of which are directed parallel to the plane of rotation of the endless conveying member 352. These legs 360, 362 are equipped with coaxial bores 364, 366, through which a rod 368 is guided. That end of the rod 368 projecting from the leg 362 in the direction of the take-up means 346 carries a forming die 370 which is equipped with a recess 372 in the form of a round dome. The recess 372 has a larger diameter than the absorbent body. If appropriate, this forming die 370 can be heated, for example by means of electrical resistance heating.

The end of the rod 368 projecting from the leg 360 of the U-shaped part 358 on the side facing away from the leg 362 carries a sensing roller 374. Into the path of movement of this sensing roller 374 extends a stationary control cam 376 with a control surface 378 which the sensing roller 374 meets. Since a helical compression spring 380 is supported between the outer face of the leg 360 of the U-shaped part 358 and the sensing roller 374, the sensing roller 374 together with the rod 368 and the forming die 370 is always prestressed in the direction of the control surface 378. Since the control cam 376 extends increasingly into the path of movement of the sensing roller 374 in the direction of movement of the conveying member 352 indicated by the arrow n, the forming die 370 is moved axially up against the preformed front end 342 of the absorbent body 30, because the take-up means 344 and the U-shaped part 358 rotate coaxially and in synchronism. Consequently, the preformed front end 342 is shaped into a round dome 35, as shown by the tampon 32 in Fig. 19. The direction of movement of the sensing roller 374 is represented by a broken arrow s. The axial stroke of the rod 368 is limited by a stop disc 382 which is fastened to that length portion of the rod 368 located between the legs 360, 362 and which normally bears against the inner face of the leg 360 under the effect of the helical compression spring 380.

The endless conveying member 354 is arranged on that side of the take-up member 350 located opposite the conveying member 352 for the forming die 372, at a distance and parallel to the take-up means conveying member 350 and is movable in synchronism with the latter. The conveying member 354 is equipped with a number of embossing devices 384 corresponding to the number of forming devices 356. These embossing devices 384 likewise consist of a U-shaped part 386,



the mutually parallel legs 388, 390 of which are once again equipped with axial bores (not shown) through which is guided a rod 392 equipped, on the outer face of the leg 388 facing the take-up means 386, with an embossing head 394, the end face of which is equipped with a convex spherical cup 396. On the outside of the conveying member 354 is arranged once again a control cam 398 with a control surface 400 which extends into the path of movement of a sensing roller 402. Between the sensing roller 402 at the lower end of the rod 392 and the leg of the U-shaped part 386, a helical compression spring 404 is arranged on the rod 392. A stop disc 404 is fastened to that part of the rod 392 extending between the legs 388, 390. The longitudinal mid-axis of the rod 392 and of the embossing head 394 is aligned coaxially with the longitudinal mid-axis of the transverse indentation 346 of the take-up means 344 and of the forming die 370. Moreover, since the control cams 376 and 398 are located opposite one another and their control surfaces 378 and 400 are of similar design, the shaping of the front end 342 of the absorbent body 30 into the form of a round dome is accompanied by a shaping of the rear end face 343 of the absorbent body 30 by the spherical cup 396 of the embossing head 394, when the sensing roller 402 meets the control surface 400, presses the embossing head 394 in the direction of the broken arrow o against the rear end face 344 of the absorbent body 30 and forms in the latter a depression 33 which, after the tampon has been finished, constitutes an insertion aid for the tampon.

#### Process

The essential steps in the processing of the web of fibre material 40 are summarised once again below.

Referring to Figs. 1 to 6, in the folding station A the web of fibre material 40 is subjected to three longitudinal folding operations I, II and III from the right longitudinal side 56 and is thereby folded on itself, before the left longitudinal side 70 is laid round the web of fibre material in the opposite direction, thus producing a seven-layered web of fibre material 72. Profile rollers (not shown) round off the cross-section of the layered web of fibre material.

Subsequently, the web of fibre material 72 is introduced into the guide tube 86 of the sheathing-band application station B and is surrounded by the sheathing band 82, the longitudinal edges 124, 126 of which are sealed to one another. The web of fibre material 130 of round cross-section, surrounded by the sheathing band 82, comes out of the guide tube 86 and is thereafter fed to the press station C. In the roller frame 140 of the press

station C, the web of fibre material 130 is rolled down in steps at least to the final cross-section of the absorbent body 30 and a fleece rod 240 is formed. At the same time, the rolling pressure is exerted successively in steps on diametrically opposed sides of the fleece rod 240, the pressing direction being mutually offset respectively at 90°. The fleece rod 240 is preferably rolled down to a cross-section which is made smaller than the final cross-section of the absorbent body 30, when tampons 32 for feminine hygiene are to be produced from the absorbent body. This does not preclude the possibility that, in other instances too, rolling down beyond the final cross-section of the absorbent body will be expedient. Fig. 18 shows that, during continuous rolling, the fleece rod 240 is equipped with four longitudinal grooves 31 which are located diametrically opposite one another in pairs. It is also evident that the cross-section of the fleece rod 240 is reduced first relatively sharply and then more slowly in the direction of movement x, before the outer surface of the fleece rod 240 is smoothed and calibrated at the end of the roller frame 140. It can be expedient to heat the fleece rod during press-rolling in order to increase its dimensional stability.

As explained in conjunction with Figs. 8 to 14, during the successive pressing stages the fleece rod 240 is guided positively through the said guide surrounds 250 to 274.

The pressed fleece rod 240 is thereafter fed to the severing station D in which portions of the fleece rod 240 which correspond to the length of an absorbent body 30 are severed from one another by pinch-rolling the fleece rod diametrically and in a manner offset in steps at 90°, with the exception of an axial connecting web between the portions. At the same time, the front end of each length portion is preformed in a dome-like manner during the pinching operation. Subsequently, the individual absorbent bodies are severed in the region of the thin connecting web. The preformed dome-shaped front end of the absorbent body is thereafter shaped definitively by smoothing. At the same time, a hemispherical depression is formed in the rear end of the absorbent body, as an insertion aid for a tampon 32 according to Fig. 19 which is produced from the absorbent body. Subsequently, in a way which is conventional and therefore not shown in detail, the recovery band 36, the ends of which are connected to one another, for example by means of a knot 37, is fastened to the rear end of the tampon.

#### Reference Symbols

A  
Folding station

B		72
Sheathing-band application station		Seven-layered web of fibre material
C		80
Press station		Stock roll
D	5	82
Severing station		Sheathing band
30		84
Absorbent body		Lead roller
31		86
Longitudinal grooves	10	Guidetube
32		88
Tampon		Longitudinal slot
33		90
Depression		Conveyor belt
34	15	91
Rear end		Support plate
35		92
Round dome		Upper strand
36		94
Recovery band	20	Driving roller
37		96
Knot		Deflecting roller
38		98
Stock roll		Left introduction slot
39	25	100
Absorbent body		Right introduction slot
40		102, 104, 106
Web of fibre material		Segments
42		108
Guide plate	30	Trailing edge (Segment 102)
44		110
Endless conveyor belt		Leading edge (Segment 104)
46		112
Stand parts		Trailing edge (Segment 104)
48	35	114
Stand parts		Leading edge (Segment 106)
50		116
Guide surrounds		Left side tab
52		118
Folding plate	40	Right side tab
54		120
Folding disc		Longitudinal slot
56		122
Right longitudinal side		Closing device
58	45	124, 126
Right longitudinal edge		Longitudinal edges
60		128
Left longitudinal edge		Hot-sealing roller
62		130
First fold	50	Rounded sheathed web of fibre material
64		139
Longitudinal fold		Feed tube
66		140
Four-layered stack		Roller frame
68	55	142, 144
Uncovered part		Pairs of rollers
70		146, 148
Left longitudinal side		Pairs of rollers

150, 152		278
Pairs of rollers		Major axis
154, 156		280
Pairs of rollers		Minor axis
160, 162, 164	5	282
Pairs of rollers		Flanks
165		284
Nip		Flanks
166, 168		286
Roller profiles	10	Upper roller
170		288
Upper roller		Lower roller
172		290
Lower roller		Lateral jaws
174	15	292
Profile bottom		Lateral jaws
176		294
Profile bottom		Guide face
178		296
Left vertical roller	20	Guide rib
180		298
Right vertical roller		Guide rib
182, 184, 186, 188		300, 302
Circumferential rib		Flanks
190	25	304, 306
Fleece rod		Flanks
192, 194, 196, 198		308, 310
Longitudinal grooves		Vertical press rollers
200		312, 314
Upper roller	30	Front ends
202		316, 318
Lower roller		Front corners
204		320
Vertical rollers		U-shaped cross-section
206	35	322, 324
Vertical rollers		Length portion
208, 210, 212, 214		330, 332
Circumferential ribs		Pairs of pinching rollers
216, 218, 220, 222		334, 336
Longitudinal grooves	40	Pinching projections
224		338, 340
Left roller		342
226		Preformed front end
Right roller		343
228	45	Lower end face
Upper roller		344
230		Take-up means
Lower roller		346
232		U-shaped transverse indentation
Basic form of an arc of a circle	50	348
234		Take-up means lid
Circumferential rib		350, 352, 354
240		Endless conveying members
Fleece rod		356
250 - 274	55	Dome-forming device
Guide surrounds		358
276		U-shaped part
Free elliptic cross-section		360, 362

Legs			stages of rolling pressure at least to a final
364, 366			cross-section of the absorbent body and a
Bores			fleece rod having an outer surface is formed
368			thereby, before portions corresponding to the
Rod	5		length of the absorbent body are subdivided.
370			
Forming die		2.	Process according to Claim 1, characterized in
372			that the rolling pressure is exerted succes-
Recess in the form of a round dome			sively in steps in an invert pressing direction at
374	10		each stage on diametrically opposed sides of
Sensing roller			the fleece rod, the pressing direction being
376			mutually offset respectively at 90° about the
Control cam			fleece rod from stage to stage.
378			
Control face	15	3.	Process according to Claims 1 or 2, character-
380			ized in that the fleece rod is rolled down to a
Helical compression spring			cross-section which is smaller than the final
382			cross-section of the absorbent body.
Stop disc			
384	20	4.	Process according to one of Claims 1 to 3,
Embossing device			characterized in that the fleece rod is provided
386			with longitudinal grooves during the rolling.
U-shaped part			
388		5.	Process according to Claim 4, characterized in
Leg	25		that the fleece rod is provided with two pairs of
390			diametrically opposed longitudinal grooves.
Leg			
392		6.	Process according to one of Claims 1 to 5,
394			characterized in that the cross-section of the
Embossing head	30		fleece rod is reduced first relatively sharply
396			and then more slowly, before the outer surface
Spherical cup			of the fleece rod is smoothed and calibrated.
398, 310			
Vertical press rollers		7.	Process according to one of Claims 1 to 6,
398	35		characterized in that the fleece rod is heated
Control cam			during the press-rolling.
400			
Control surface		8.	Process according to one of the Claims 1 to 7,
402			characterized in that the fleece rod is guided
Sensing roller	40		positively between the successive press
404			stages.
Helical compression spring			
		9.	Process according to one of Claims 1 to 8,
	45		characterized in that, before the press-rolling,
			the web of fibre material is folded round onto
			itself in parallel with the longitudinal direction
	50		several times from one longitudinal edge of the
			web in parallel with the longitudinal direction,
			before a second longitudinal edge of the web
			is laid around onto the multi-layered web of
			fibre material in an opposite direction.
		10.	Process according to one of Claims 1 to 9,
	55		characterized in that the folded multi-layered
			web has a rounded cross-section of fibre ma-
			terial.

## Claims

1. Process for the continuous production of absorbent bodies, especially tampons, preferably for feminine hygiene, comprising layering a continuous web of fibre material while moving said web in a direction of advance by folding said web about its longitudinal axis, said web is subsequently pressed radially by means of press rollers and thereafter is subdivided into length portions, characterized in that the web of fibre material is folded round onto itself in parallel with the longitudinal direction, whereafter the web of fibre material is rolled down in steps in a plurality of successive press

11. Process according to one of Claims 1 to 10, characterized in that a web of fibre material has a width of 15-40 cm prior to the folding of the web. 5
12. Process according to Claim 11, characterized in that, before the press-rolling, the web of fibre material of round cross-section is surrounded by a liquid-permeable sheathing band with overlapping longitudinal edges. 10
13. Process according to Claim 12, characterized in that the overlapping longitudinal edges of the sheathing band are connected to one another. 15
14. Process according to Claim 13, characterized in that the longitudinal edges of the sheathing band are connected by the welding together of thermoplastic constituents of the sheathing band. 20
15. Process according to Claims 13 or 14, characterized by the sheathing band being a non-woven web. 25
16. Process according to one of Claims 1 to 15, characterized in that portions of the fleece rod which correspond to the length of an absorption body are partially severed from one another by pinch-rolling the fleece rod diametrically and in a manner offset in steps at 90°, leaving a thin axial connecting web between the portions. 30
17. Process according to Claim 16, characterized in that the front end of each length portion is formed into a dome-like shape during the pinching operation. 35
18. Process according to Claims 16 or 17, characterized in that the individual absorbent bodies are severed at the thin connecting web. 40
19. Process according to Claims 16 to 18, characterized in that a hemispherical depression (33) is formed in an end of the absorbent body as an insertion aid. 45
20. Apparatus for making an absorbent body (30) comprising means for supplying a continuous web of fibre material (130), a folding station (A) with plates and rotatable discs for longitudinal folding of the web of fibre material (130), and a pair of press rollers followed by a cutting device (D), characterized in that the folding station (A) is followed by a roller frame (140) with a plurality of pairs of press rollers (142 to 156) forming nips (165) there between, the nips (165) of the pairs of press rollers (142 to 156) being reduced in steps and the press rollers rotating at a mean circumferential speed about axis of rotation. 50
21. Apparatus according to Claim 20, characterized in that the pairs of press rollers (142 to 156) are successively offset respectively at 90° relative to one another. 55
22. Apparatus according to Claim 20 or 21, characterized in that the roller frame (140) has three groups of a plurality of pairs of rollers (142, 144, 146, 148; 150, 152, 154, 156; 158, 160, 162, 164), the nips (165) of the first group of pairs of press rollers (142, 144, 146, 148) are successively reduced in steps greater than a reduction in the nips (165) of the following second group of pairs of press rollers (150, 152, 154, 156), and the third group of pairs of rollers (158, 160, 162, 164) have a constant nip size for smoothing.
23. Apparatus according to one of Claims 20 to 22, characterized in that the circumference of each press roller is provided with at least one circumferential rib (182, 184, 186, 188).
24. Apparatus according to one of Claims 20 to 23, characterized in that guides (252 to 274) fill interspaces between the successive pairs of rollers for the positive guidance of the fleece rod.
25. Apparatus according to claim 20 to 24 characterized in that the guides (252 to 274) define a clear cross-sectional opening which is essentially elliptic, a major axis of the elliptic cross-section of each guide being arranged parallel to the axes of rotation of the respective preceding pair of rollers (142 to 164).
26. Apparatus according to any one of Claims 20 to 25, characterized in that the folding station (B) is followed by an essentially conical guide tube (86) for stabilizing a round cross-section of the multi-layered web of fibre material (72).
27. Apparatus according to Claim 26 characterized in that the guide tube (86) defines, on an underside, a longitudinal slot (88), in which a conveyor belt (90) for the rounded web of fibre material (72) is positioned.
28. Apparatus according to Claim 27 characterized by a continuous supply of liquid-permeable sheathing band (82) between a top side of the conveyor belt (90) and the rounded web of

fibre material (72) resting on it, so that the sheathing band (82) is taken up in a conveying direction as a result of a frictional connection between the sheath and conveyor belt.

29. Apparatus according to Claim 26 characterized in that a pair of drivable lead rollers are arranged on both sides of the guide tube (86) for laying a U-shaped sheathing band (82) onto an outer face of the guide tube (86) in such a way that the sheathing band (82) is conveyed slidably along on the outer face of the guide tube (86).

30. Apparatus according to Claim 26 characterized in that the guide tube (86) is positioned upstream from a first pair of rollers, the guide tube (86) having an introduction slot (98, 100) for each of two side tabs (116, 118) of a sheathing band (82), the introduction slots (98, 100) being offset axially in such a way that the two side tabs (116, 118) of the sheathing band (82) can be laid through the introduction slots (98, 100) onto the web of fibre material in the guide tube (86).

31. Apparatus according to Claim 30, wherein the guide tube (86) in the region of the introduction slot (98, 100), consists of individual distinct segments (102, 104, 106).

32. Apparatus according to Claim 26, characterized in that there are means for supplying a sheathing band (82) around the web and a closing device (122) is arranged above a longitudinal slot (120) in a top portion of the guide tube (86) for closing and overlapping longitudinal edges (124, 126) of the sheathing band (86).

33. Apparatus according to Claim 20, characterized in that after the roller frame there is positioned a severing station (D) of at least two pairs of pinching rollers (330, 332) offset at 90° and having pinching projections (334, 336, 338, 340) for pinching off portions of continuous web (240) at intervals which correspond to a length of the absorbent body, so as to leave a thin axial connecting web between the portions of the continuous web.

34. Apparatus according to Claim 33, characterized in that the pinching projections (334, 336, 338, 340) provide a front end (342) of each of the absorbent bodies with a dome-like shape.

35. Apparatus according to Claim 34, characterized in that at least one pair of cutting rollers is

provided at the end of the severing station (D) for severing the thin axial connecting (240) between successive portions of the continuous web.

36. Apparatus according to Claim 20, characterized in that the cutting device is followed by a dome-forming device (356) for smoothing a preformed front end (342) of the absorbent body (30).

37. Apparatus according to Claim 36, characterized in that the dome-forming device (356) includes an embossing device (384) for forming a depression (33) in a rear end (344) of the absorbent body (30) opposite said front end.

38. Apparatus according to Claim 20, wherein a control device is provided for maintaining the same mean circumferential speed of all the pairs of press and smoothing rollers arranged in the roller frame (140).

## Patentansprüche

1. Verfahren zum kontinuierlichen Herstellen von Absorptionskörpern, insbesondere Tampons, vorzugsweise für die Frauenhygiene, bei welchem eine endlose Fasermaterialbahn kontinuierlich in Vorschubrichtung um ihre Längsachse durch Falten geschichtet und anschließend mittels Preßwalzen radial gepreßt und danach in Längenabschnitte unterteilt wird, dadurch gekennzeichnet, daß die Fasermaterialbahn parallel zu der Längsrichtung auf sich selbst rund gefaltet wird, woraufhin die Fasermaterialbahn stufenweise in mehreren aufeinanderfolgenden Preßstufen des Preßwalzens zumindest bis auf den Endquerschnitt des Absorptionskörpers heruntergewalzt und ein Vliesstrang geformt wird, der eine dadurch geformte, äußere Oberfläche hat, bevor der Länge des Absorptionskörpers entsprechende Abschnitte von dem Vliesstrang abgetrennt werden.

2. Verfahren nach Anspruch 1, dadurch gekennzeichnet, daß der Walzdruck stufenweise aufeinanderfolgend in einer versetzten Preßrichtung in jeder Stufe auf sich diametral gegenüberliegende Seiten des Vliesstranges ausgeübt wird, wobei die Preßrichtung um jeweils 90° um den Vliesstrang von Stufe zu Stufe gegeneinander versetzt ist.

3. Verfahren nach den Ansprüchen 1 oder 2, dadurch gekennzeichnet, daß der Vliesstrang bis

auf einen Querschnitt heruntergewalzt wird, der kleiner als der Endquerschnitt des Absorptionskörpers bemessen ist.

4. Verfahren nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß der Vliesstrang während des Walzens mit Längsrillen versehen wird. 5
5. Verfahren nach Anspruch 4, dadurch gekennzeichnet, daß der Vliesstrang mit zwei Paaren von sich diametral gegenüberliegenden Längsrillen versehen wird. 10
6. Verfahren nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der Querschnitt des Vliesstranges zunächst stärker, dann langsamer verringert wird, ehe die äußere Oberfläche des Vliesstranges geglättet und kalibriert wird. 15 20
7. Verfahren nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der Vliesstrang während des Preßwalzens erwärmt wird. 25
8. Verfahren nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß der Vliesstrang zwischen den aufeinanderfolgenden Preßstufen formschlüssig geführt wird. 30
9. Verfahren nach einem der Ansprüche 1 bis 8, dadurch gekennzeichnet, daß die Fasermaterialbahn vor dem Preßwalzen von einem Längsrand der Bahn her parallel zur Längsrichtung mehrfach parallel zur Längsrichtung auf sich selbst umgefaltet wird, ehe ein zweiter Längsrand auf die mehrschichtige Fasermaterialbahn in umgekehrter Richtung umgelegt wird. 35
10. Verfahren nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß die gefaltete, mehrschichtige Fasermaterialbahn einen gerundeten Querschnitt des Fasermaterials aufweist. 40 45
11. Verfahren nach einem der Ansprüche 1 bis 10, dadurch gekennzeichnet, daß eine Fasermaterialbahn vor dem Falten der Bahn eine Breite von 15 - 40 cm hat. 50
12. Verfahren nach Anspruch 11, dadurch gekennzeichnet, daß die im Querschnitt runde Fasermaterialbahn vor dem Preßwalzen mit einem flüssigkeitsdurchlässigen Hüllband mit sich überlappenden Längsrändern umgeben wird. 55
13. Verfahren nach Anspruch 12, dadurch gekennzeichnet, daß die sich überlappenden Längs-

ränder des Hüllbandes miteinander verbunden werden.

14. Verfahren nach Anspruch 13, dadurch gekennzeichnet, daß die Verbindung der Längsränder durch Verschweißen thermoplastischer Bestandteile des Hüllbandes erfolgt.
15. Verfahren nach den Ansprüchen 13 oder 14, gekennzeichnet durch die Verwendung eines Hüllbandes aus Non-woven.
16. Verfahren nach einem der Ansprüche 1 bis 15, dadurch gekennzeichnet, daß der Länge eines Absorptionskörpers entsprechende Abschnitte des Vliesstranges durch diametrales und stufenweise um 90° versetztes Quetschwalzen des Vliesstranges bis auf einen dünnen axialen Verbindungssteg zwischen den Abschnitten voneinander getrennt werden.
17. Verfahren nach Anspruch 16, dadurch gekennzeichnet, daß das Vorderende jedes Längenabschnitts beim Abquetschen kuppenartig geformt wird.
18. Verfahren nach Anspruch 16 oder 17, dadurch gekennzeichnet, daß die einzelnen Absorptionskörper im Bereich des dünnen Verbindungssteges durchtrennt werden.
19. Verfahren nach den Ansprüchen 16 bis 18, dadurch gekennzeichnet, daß in dem hinteren Ende des Absorptionskörpers eine halbrunde Delle (33) als Einführhilfe geformt wird.
20. Einrichtung zum Herstellen eines Absorptionskörpers (30) umfassend Mittel zum Zuführen einer endlosen Fasermaterialbahn (130), eine Faltstation (A) mit Platten und drehbaren Scheiben zum Längsfalten der Fasermaterialbahn (130) sowie ein Paar Preßwalzen, dem eine Schneidvorrichtung (D) nachgeschaltet ist, dadurch gekennzeichnet, daß der Faltstation (A) ein Walzenstuhl (140) mit einer Mehrzahl von dazwischen Walzenspalte (165) bildenden Preßwalzenpaaren (142 bis 156) nachgeschaltet ist, wobei die Walzenspalte (165) der Preßwalzenpaare stufenweise verringert sind und die Preßwalzen sich mit einer mittleren Umfangsgeschwindigkeit drehen.
21. Einrichtung nach Anspruch 20, dadurch gekennzeichnet, daß die Preßwalzenpaare (142 bis 156) aufeinanderfolgend um jeweils 90° gegeneinander versetzt sind.

22. Einrichtung nach Anspruch 20 oder 21, dadurch gekennzeichnet, daß der Walzenstuhl (140) drei Gruppen einer Mehrzahl von Preßwalzenpaaren (142, 144, 146, 148; 150, 152, 154, 156; 158, 160, 162, 164) aufweist, wobei die Walzenspalte (165) der ersten Gruppe von Preßwalzenpaaren (142, 144, 146, 148) aufeinanderfolgend stufenweise stärker reduziert sind als eine Reduktion der Walzenspalte (165) der darauffolgenden zweiten Gruppe von Preßwalzenpaaren (150, 152, 154, 156), und daß die dritte Gruppe von Walzenpaaren (158, 160, 162, 164) eine konstante Spaltgröße zum Glätten hat.
23. Einrichtung nach einem der Ansprüche 20 bis 22, dadurch gekennzeichnet, daß der Umfang jeder Preßwalze mit mindestens einer Umfangsrippe (182, 184, 186, 188) versehen ist.
24. Einrichtung nach einem der Ansprüche 20 bis 23, dadurch gekennzeichnet, daß Leitblenden (252 bis 274) die Zwischenräume zwischen den aufeinanderfolgenden Walzenpaaren (142 bis 164) zur formschlüssigen Führung des Vliesstranges (240) ausfüllen.
25. Einrichtung nach einem der Ansprüche 20 bis 24, dadurch gekennzeichnet, daß der lichte Querschnitt der Leitblenden (252 bis 274) im wesentlichen elliptisch ist, wobei die Hauptachse (278) des elliptischen Querschnitts jeder Leitblende parallel zu den Drehachsen des jeweils vorangehenden Walzenpaares (142 bis 164) angeordnet ist.
26. Einrichtung nach einem der Ansprüche 20 bis 25, dadurch gekennzeichnet, daß der Faltstation (B) ein im wesentlichen kreiszylindrisches Führungsrohr (86) zum Stabilisieren des runden Querschnitts der mehrschichtigen Faser-materialbahn (72) nachgeordnet ist.
27. Einrichtung nach Anspruch 26, dadurch gekennzeichnet, daß das Führungsrohr (86) an der Unterseite mit einem Längsschlitz (88) versehen ist, in dem ein Transportband (90) für die gerundete Faser-materialbahn (72) angeordnet ist.
28. Einrichtung nach Anspruch 27, gekennzeichnet durch kontinuierliche Zufuhr eines endlosen, flüssigkeitsdurchlässigen Hüllbandes (82) zwischen einer Oberseite des Transportbandes (90) und der daraufliegenden, gerundeten Faser-materialbahn (72), so daß das Hüllband (82) durch Reibungsschluß zwischen dem Hüllband und dem Transportband in Transportrichtung

(x) mitnehmbar ist.

29. Einrichtung nach Anspruch 26, dadurch gekennzeichnet, daß ein Paar antreibbarer Leitrollen beidseitig des Führungsrohres (86) zum U-förmigen Umlegen des Hüllbandes (82) auf einer Außenseite des Führungsrohres (86) angeordnet ist, derart, daß das Hüllband (82) außen am Führungsrohr (86) entlang gleitend transportiert wird.
30. Einrichtung nach Anspruch 26, dadurch gekennzeichnet, daß das Führungsrohr (86) stromaufwärts eines ersten Rollenpaares positioniert ist, wobei das Führungsrohr (86) einen Einführschlitz (98, 100) für jeden der beiden Seitenlappen (116, 118) eines Hüllbandes (82) hat und die Einführschlitze (98, 100) axial derart versetzt sind, daß die beiden Seitenlappen (116, 118) des Hüllbandes (82) durch die Einführschlitze (98, 100) hindurch auf die Faser-materialbahn (72) im Führungsrohr (86) aufgelegt werden können.
31. Einrichtung nach Anspruch 30, dadurch gekennzeichnet, daß das Führungsrohr (86) im Bereich des Einführschlitzes (98, 100) aus einzelnen, unterschiedlichen Segmenten (102, 104, 106) besteht.
32. Einrichtung nach Anspruch 26, dadurch gekennzeichnet, daß Mittel zum Zuführen eines Hüllbandes (82) rund um die Bahn vorgesehen sind und eine Schließvorrichtung (122) oberhalb eines Längsschlitzes (120) in der Oberseite des Führungsrohres (86) zum Schließen und Überlappen der Längsränder (124, 126) des Hüllbandes (86) angeordnet ist.
33. Einrichtung nach Anspruch 20, dadurch gekennzeichnet, daß hinter dem Walzenstuhl (140) eine Trennstation (D) mit mindestens zwei um 90° versetzten Quetschwalzenpaaren (330, 332) mit Quetschnocken (334, 336, 338, 340) zum Abquetschen von der Länge des Absorptionskörpers (30) entsprechenden Abschnitten des Vliesstranges (240) unter Belastung eines dünnen axialen Verbindungssteiges zwischen den Vliesstrangabschnitten angeordnet ist.
34. Einrichtung nach Anspruch 33, dadurch gekennzeichnet, daß die Quetschnocken (334, 336, 338, 340) die Vorderenden (342) der Absorptionskörper (30) mit einer kuppenartigen Form versehen.



35. Einrichtung nach Anspruch 34, dadurch gekennzeichnet, daß mindestens ein Schneidwalzenpaar am Ende der Trennstation (D) zum Durchtrennen des dünnen, axialen Verbindungssteiges (240) zwischen aufeinanderfolgenden Abschnitten der kontinuierlichen Bahn vorgesehen ist. 5
36. Einrichtung nach Anspruch 20, dadurch gekennzeichnet, daß der Schneidvorrichtung eine Kuppenformvorrichtung (356) zum Glätten eines vorgeformten Vorderendes (342) des Absorptionskörpers (30) nachgeschaltet ist. 10
37. Einrichtung nach Anspruch 36, dadurch gekennzeichnet, daß der Kuppenformvorrichtung (356) eine Prägevorrückung (384) zum Formen einer Delle (33) in einem hinteren, dem Vorderende gegenüberliegenden Ende (344) des Absorptionskörpers (30) zugeordnet ist. 15 20
38. Einrichtung nach Anspruch 20, dadurch gekennzeichnet, daß eine Steuervorrichtung zur Aufrechterhaltung der gleichen mittleren Umfangsgeschwindigkeit sämtlicher, im Walzenstuhl (140) angeordneter Preß- und Glättwalzenpaare vorgesehen ist. 25

#### Revendications

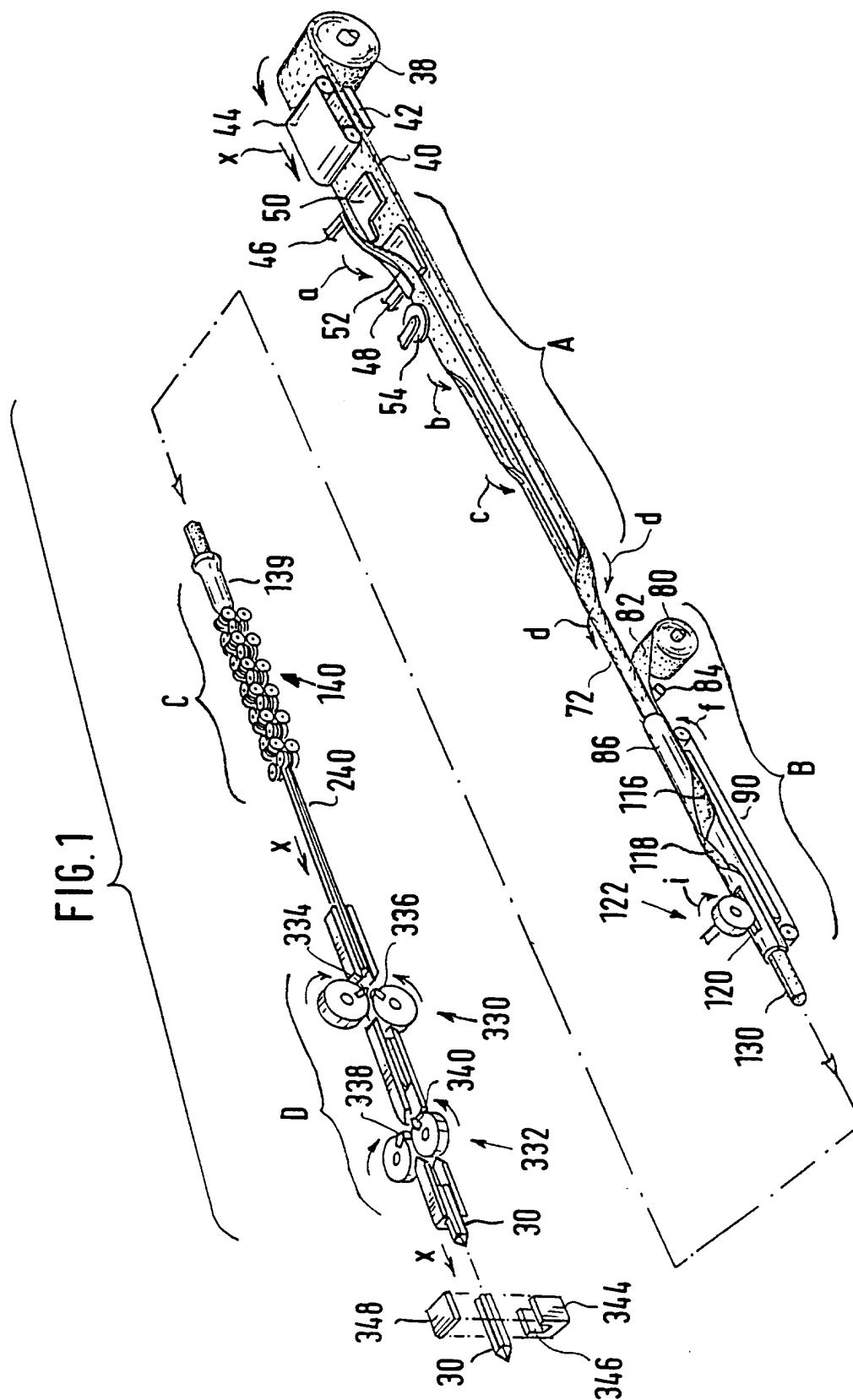
1. Procédé de production continue de corps absorbants, en particulier de tampons, de préférence pour l'hygiène féminine, comprenant les étapes consistant à disposer en couche une bande continue de matière fibreuse tout en déplaçant ladite bande vers l'avant en pliant ladite bande autour de son axe longitudinal, ladite bande étant ensuite comprimée radialement au moyen de cylindres compresseurs et étant ensuite subdivisée en portions longitudinales, caractérisé en ce que la bande de matière fibreuse est enroulée sur elle-même parallèlement à la direction longitudinale, suite à quoi la bande de matière fibreuse est roulée par étapes selon plusieurs phases successives de compression par pression de roulage pour donner au moins une section transversale finale du corps absorbant et former de ce fait un rouleau ouaté présentant une surface extérieure, avant que des portions correspondant à la longueur du corps absorbant ne soient subdivisées. 30 35 40 45 50
2. Procédé selon la Revendication 1, caractérisé en ce que la pression de roulage est exercée successivement par étapes, et s'exerce à chaque phase dans une direction de compression inverse sur les côtés diamétralement opposés 55

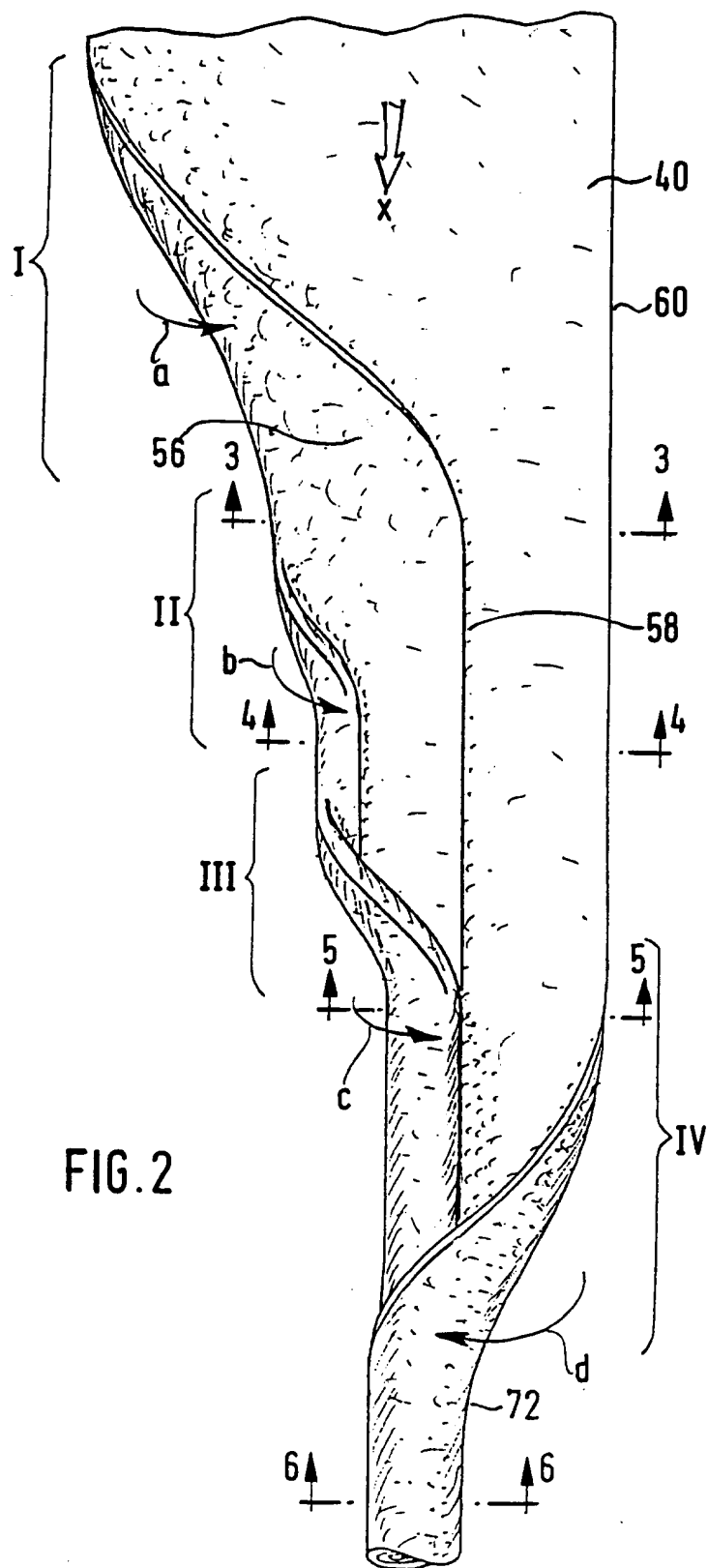
du rouleau ouaté, la direction de compression étant respectivement décalée de 90 ° de chaque côté du rouleau ouaté à chaque étape.

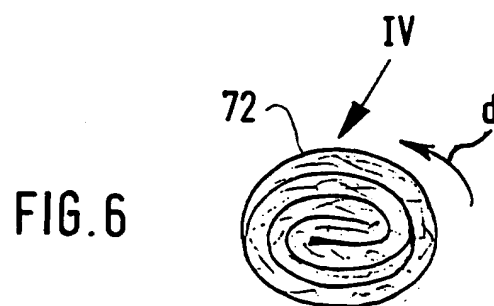
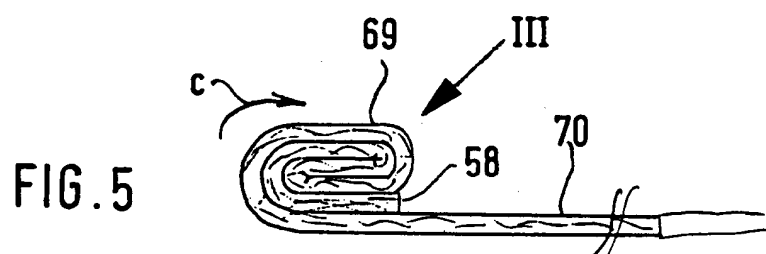
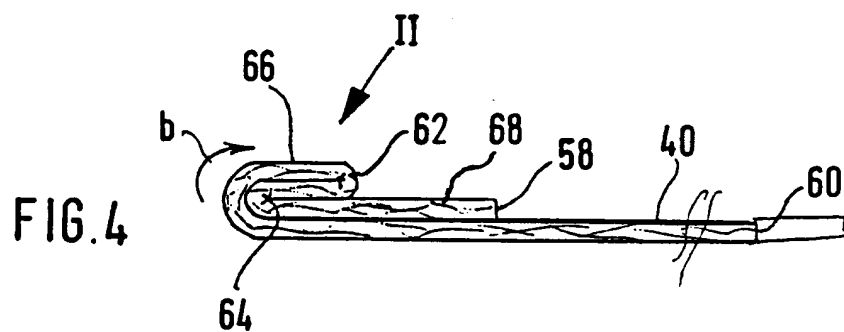
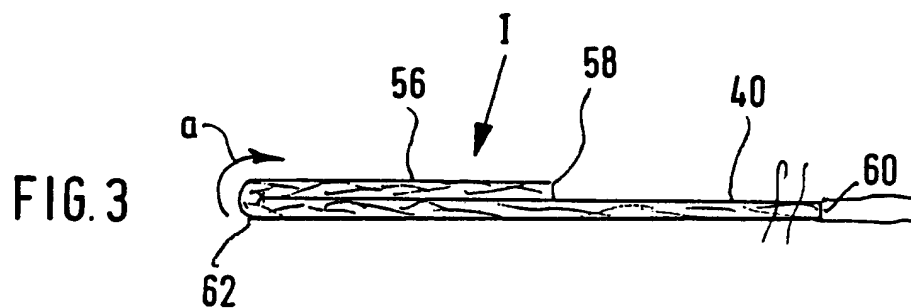
3. Procédé selon la Revendication 1 ou 2, caractérisé en ce que le rouleau ouaté est roulé pour former une section transversale plus petite que la section transversale finale du corps absorbant.
4. Procédé selon l'une des Revendications 1 à 3, caractérisé en ce que le rouleau ouaté est pourvu de rainures longitudinales au cours du roulage.
5. Procédé selon la Revendication 4, caractérisé en ce que le rouleau ouaté est pourvu de deux paires de rainures longitudinales diamétralement opposées.
6. Procédé selon l'une des Revendications 1 à 5, caractérisé en ce que la section transversale du rouleau ouaté est tout d'abord réduite de façon relativement importante, puis plus légèrement, avant que la surface extérieure du rouleau ouaté ne soit lissée et calibrée.
7. Procédé selon l'une des Revendications 1 à 6, caractérisé en ce que le rouleau ouaté est chauffé au cours de la compression par roulage.
8. Procédé selon l'une des Revendications 1 à 7, caractérisé en ce que le rouleau ouaté est positivement guidé entre les phases de compression successives.
9. Procédé selon l'une des Revendications 1 à 8, caractérisé en ce que, avant la compression par roulage, la bande de matière fibreuse est pliée puis enroulée plusieurs fois sur elle-même parallèlement à la direction longitudinale d'un bord longitudinal de la bande parallèlement à la direction longitudinale, avant qu'un second bord longitudinal de la bande ne soit enroulé en sens inverse sur la bande de matière fibreuse multicouche.
10. Procédé selon l'une des Revendications 1 à 9, caractérisé en ce que la bande multicouche pliée présente une section transversale de matière fibreuse arrondie.
11. Procédé selon l'une des Revendications 1 à 10, caractérisé en ce qu'une bande de matière fibreuse présente une largeur comprise entre 15 et 40 cm avant qu'elle ne soit pliée.

12. Procédé selon la Revendication 11, caractérisé en ce que, avant la compression par roulage, la bande de matière fibreuse de section transversale arrondie est entourée d'une bande enveloppante perméable aux liquides dont les bords longitudinaux se chevauchent. 5
13. Procédé selon la Revendication 12, caractérisé en ce que les bords longitudinaux se chevauchant de la bande enveloppante sont fixés l'un à l'autre. 10
14. Procédé selon la Revendication 13, caractérisé en ce que les bords longitudinaux de la bande enveloppante sont fixés par thermocollage des constituants de la bande enveloppante. 15
15. Procédé selon les Revendications 13 ou 14, caractérisé en ce que la bande enveloppante est un tissu non-tissé. 20
16. Procédé selon l'une des Revendications 1 à 15, caractérisé en ce que des portions du rouleau ouaté correspondant à la longueur d'un corps absorbant sont partiellement séparées les unes des autres par roulage et pincement du rouleau ouaté diamétralement et par étapes, de façon décalée à raison de 90 °, pour laisser une fine bande axiale de jonction entre les portions. 25 30
17. Procédé selon la Revendication 16, caractérisé en ce que l'extrémité frontale de chaque portion longitudinale est formée de façon à présenter une configuration bombée au cours de l'opération de pincement. 35
18. Procédé selon la Revendication 16 ou 17, caractérisé en ce que chacun des corps absorbants est séparé au niveau de la fine bande de jonction. 40
19. Procédé selon les Revendications 16 à 18, caractérisé en ce qu'une dépression hémisphérique (33) est formée à une extrémité du corps absorbant comme aide à l'introduction. 45
20. Appareil pour la production d'un corps absorbant (30) comprenant des moyens permettant de fournir une bande continue de matière fibreuse (130), un poste de pliage (A) avec des plaques et des disques rotatifs pour le pliage longitudinal de la bande de matière fibreuse (130), et une paire de cylindres compresseurs suivie d'un dispositif de découpe (D), caractérisé en ce que le poste de pliage (A) est suivi d'une série de cylindres (140) formée de plusieurs paires de cylindres compresseurs (142 50 à 156) formant entre eux des écartements de cylindres (165), les écartements de cylindres (165) des paires de cylindres compresseurs (142 à 156) étant réduits par étapes et les cylindres compresseurs tournant à une vitesse circonférentielle moyenne autour de l'axe de rotation.
21. Appareil selon la Revendication 20, caractérisé en ce que les paires de cylindres compresseurs (142 à 156) sont successivement décalées les unes par rapport aux autres, respectivement de 90 °. 25
22. Appareil selon la Revendication 20 ou 21, caractérisé en ce que la série de cylindres (140) présente trois groupes de plusieurs paires de cylindres (142, 144, 146, 148; 150, 152, 154, 156; 158, 160, 162, 164), les écartements de cylindres (165) du premier groupe de paires de cylindres compresseurs (142, 144, 146, 148) étant successivement réduits par étapes, la réduction desdits écartements de cylindres (165) étant supérieure à celle des cylindres du second groupe de paires de cylindres compresseurs (150, 152, 154, 156), et le troisième groupe de paires de cylindres (158, 160, 162, 164) présentant un écartement de cylindres constant pour le lissage. 30
23. Appareil selon l'une des Revendications 20 à 22, caractérisé en ce que la circonférence de chaque cylindre compresseur est dotée d'au moins une nervure circonférentielle (182, 184, 186, 188). 35
24. Appareil selon l'une des Revendications 20 à 23, caractérisé en ce que des guides (252 à 274) remplissent les espacements entre les paires successives de cylindres pour le guidage positif du rouleau ouaté. 40
25. Appareil selon l'une des Revendications 20 à 24, caractérisé en ce que les guides (252 à 274) définissent une ouverture transversale distincte essentiellement elliptique, un axe principal de la section transversale elliptique de chaque guide étant disposé parallèlement aux axes de rotation de la paire de cylindres respective précédente (142 à 164). 45
26. Appareil selon l'une quelconque des Revendications 20 à 25, caractérisé en ce que le poste de pliage (B) est suivi d'un tube de guidage essentiellement conique (86) servant à stabiliser une section transversale arrondie de la bande de matière fibreuse multicouche (72). 55

27. Un appareil selon la Revendication 26, caractérisé en ce que le tube de guidage (86) définit, sur une face inférieure, une fente longitudinale (88), dans laquelle est placé un convoyeur à bande (90) servant à transporter la bande de matière fibreuse arrondie (72). 5
28. Appareil selon la Revendication 27, caractérisé par une alimentation continue en bande enveloppante perméable aux liquides (82) entre un côté supérieur du convoyeur à bande (90) et la bande de matière fibreuse arrondie (72) reposant sur celui-ci, de sorte que la bande enveloppante (82) est prélevée dans la direction de transport sous l'effet d'une adhérence entre l'enveloppe et le convoyeur à bande. 10 15
29. Appareil selon la Revendication 26, caractérisé en ce qu'une paire de cylindres menants directionnels est disposée des deux côtés du tube de guidage (86) pour poser une bande enveloppante en forme de U (82) sur une face extérieure du tube de guidage (86) de telle sorte que la bande enveloppante (82) est transportée en glissant le long de la face extérieure du tube de guidage (86). 20 25
30. Appareil selon la Revendication 26, caractérisé en ce que le tube de guidage (86) est positionné en amont d'une première paire de cylindres, le tube de guidage (86) présentant une fente d'introduction (98, 100) pour chacune des pattes (116, 118) située de chaque côté d'une bande enveloppante (82), les fentes d'introduction (98, 100) étant axialement décalées de façon à ce que les deux pattes (116, 118) situées de chaque côté de la bande enveloppante (82) puissent passer par les fentes d'introduction (98, 100) sur la bande de matière fibreuse dans le tube de guidage (86). 30 35 40
31. Appareil selon la Revendication 30, dans lequel le tube de guidage (86) est composé dans la zone de la fente d'introduction (98, 100) de segments individuels distincts (102, 104, 106). 45
32. Appareil selon la Revendication 26, caractérisé en ce qu'il existe des moyens pour placer une bande enveloppante (82) autour de la bande et qu'un dispositif de fermeture (122) est placé au dessus d'une fente longitudinale (120) dans une portion supérieure du tube de guidage (86) pour fermer et se faire chevaucher les bords longitudinaux (124, 126) de la bande enveloppante (86). 50 55
33. Appareil selon la Revendication 20, caractérisé en ce que la série de cylindres est située en amont d'un poste de séparation (D) composé d'au moins deux paires de cylindres pinçants (330, 332) décalées de 90 ° et présentant des dispositifs de pincement saillants (334, 336, 338, 340) pour arracher en pinçant des portions de bande continue (240) à des distances correspondant à une longueur du corps absorbant, et de façon à laisser une fine bande axiale de jonction entre les portions de la bande continue.
34. Appareil selon la Revendication 33, caractérisé en ce que les dispositifs de pincement saillants (334, 336, 338, 340) réalisent la forme bombée de l'extrémité frontale (342) de chacun des corps absorbants.
35. Appareil selon la Revendication 34, caractérisé en ce qu'au moins une paire de cylindres coupants est située à l'extrémité du poste de séparation (D) permettant de séparer la fine bande axiale de jonction (240) entre les portions successives de la bande continue.
36. Appareil selon la Revendication 20, caractérisé en ce que le dispositif de découpe est suivi d'un dispositif formant des dômes (356) permettant de lisser une extrémité frontale préformée (342) du corps absorbant (30).
37. Appareil selon la Revendication 36, caractérisé en ce que le dispositif formant des dômes (356) comprend un dispositif de gaufrage (384) servant à former une dépression (33) dans une extrémité arrière (344) du corps absorbant (30), opposée à ladite extrémité frontale.
38. Appareil selon la Revendication 20, dans lequel un dispositif de contrôle permet de maintenir la même vitesse circonférentielle moyenne de toutes les paires de cylindres de compression et de lissage disposées dans la série de cylindres (140).







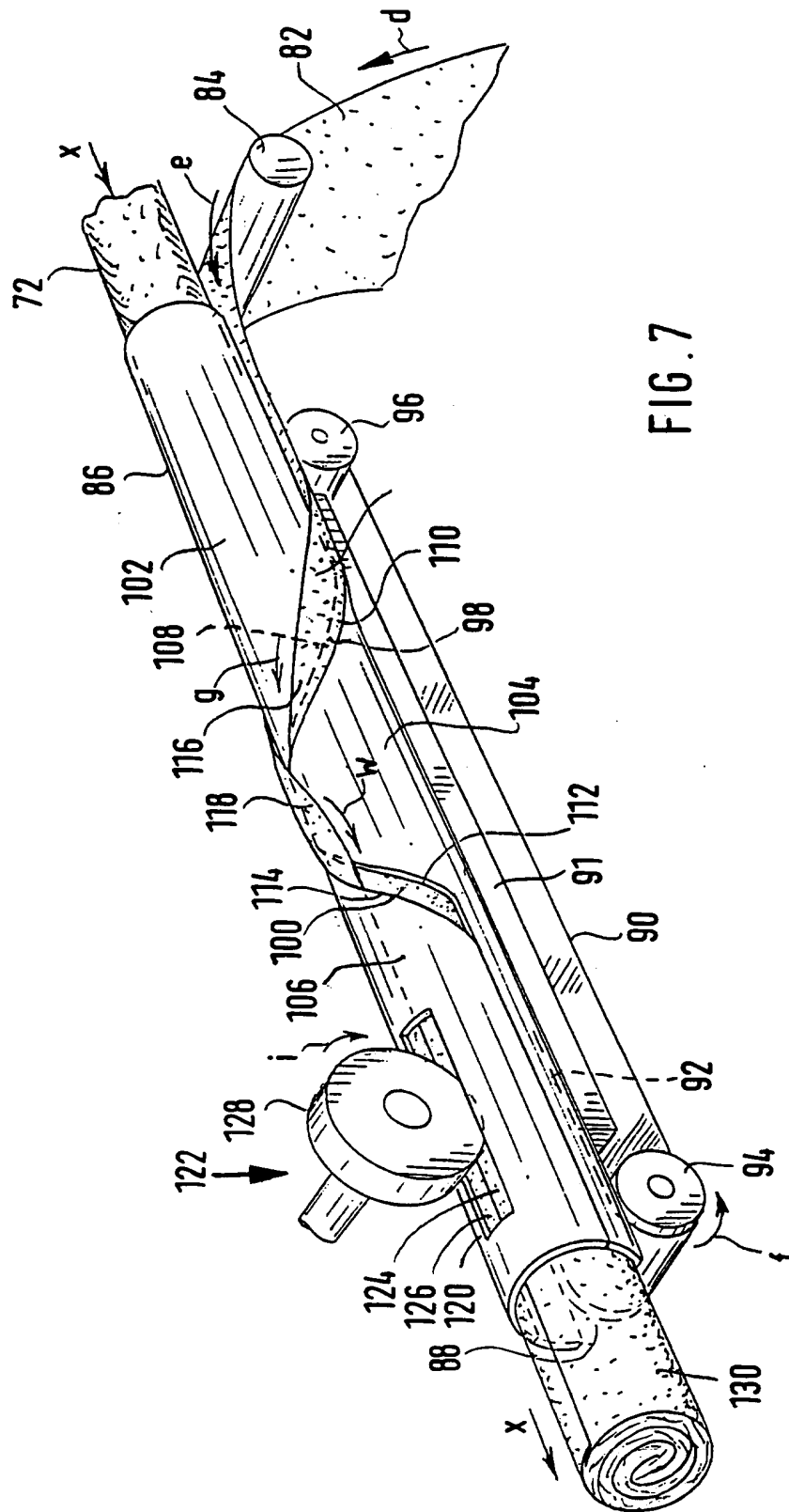
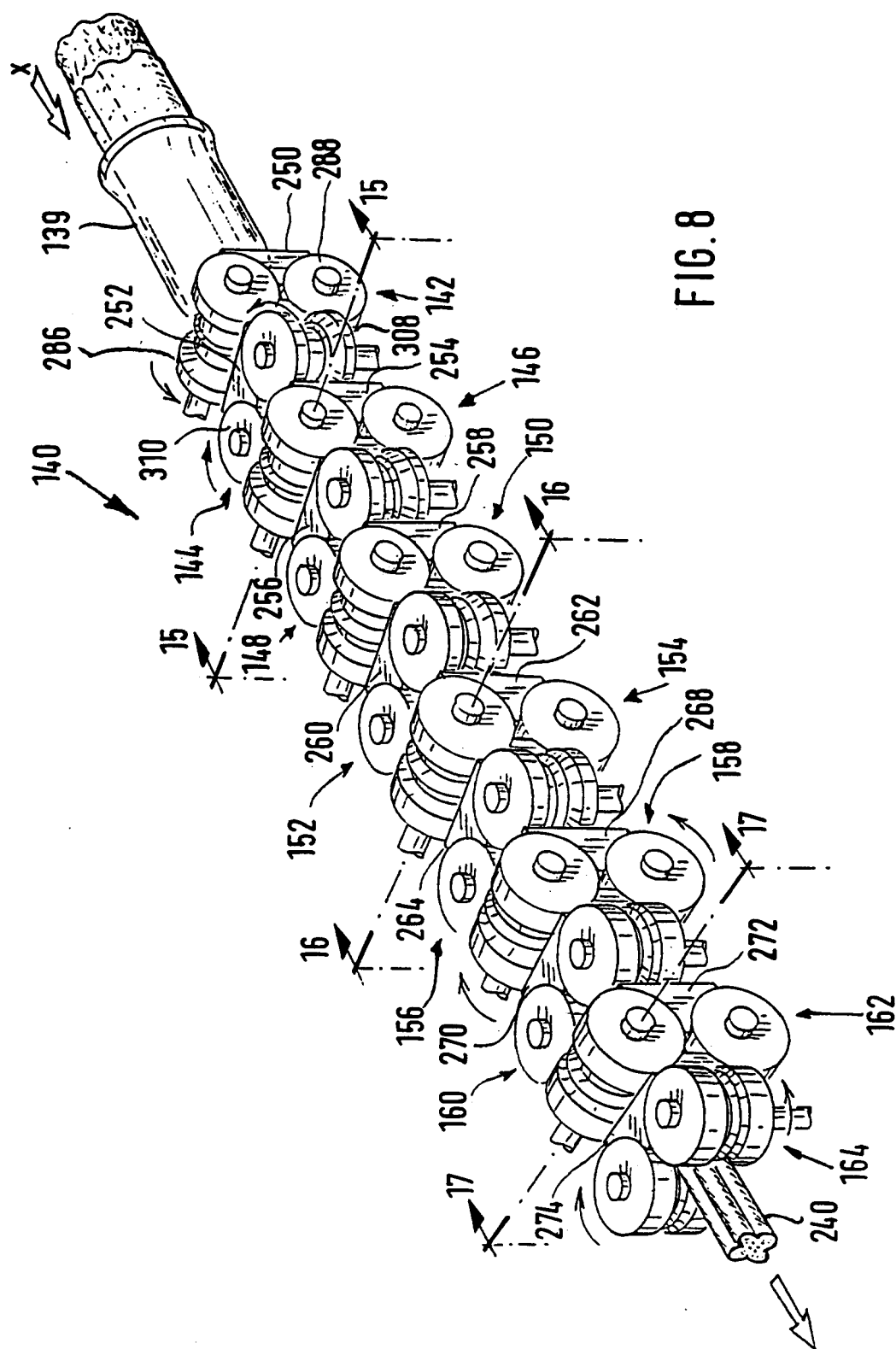
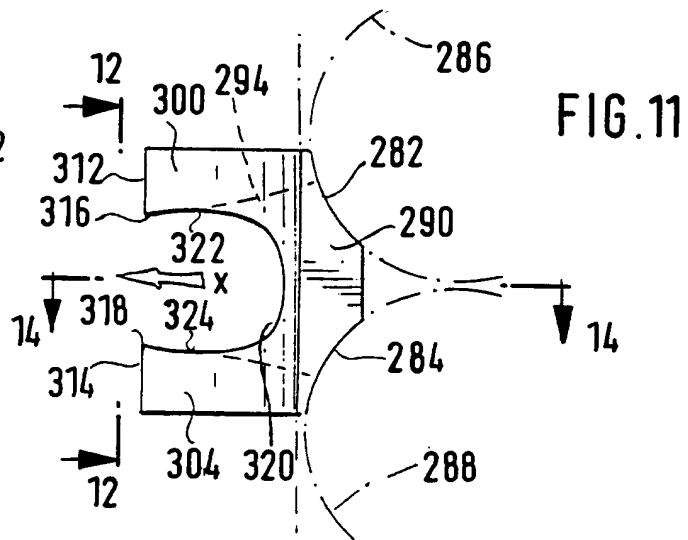
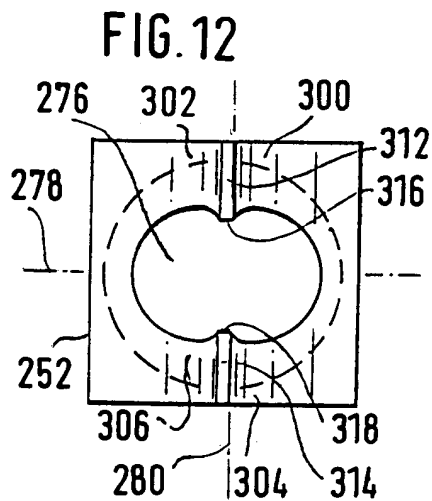
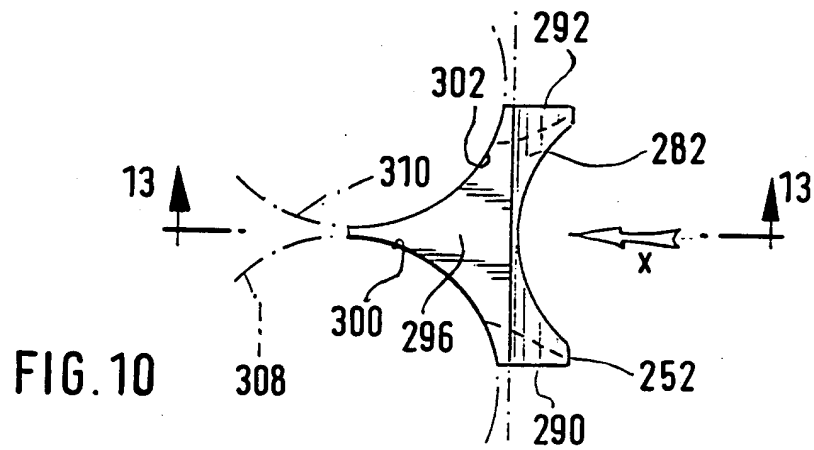
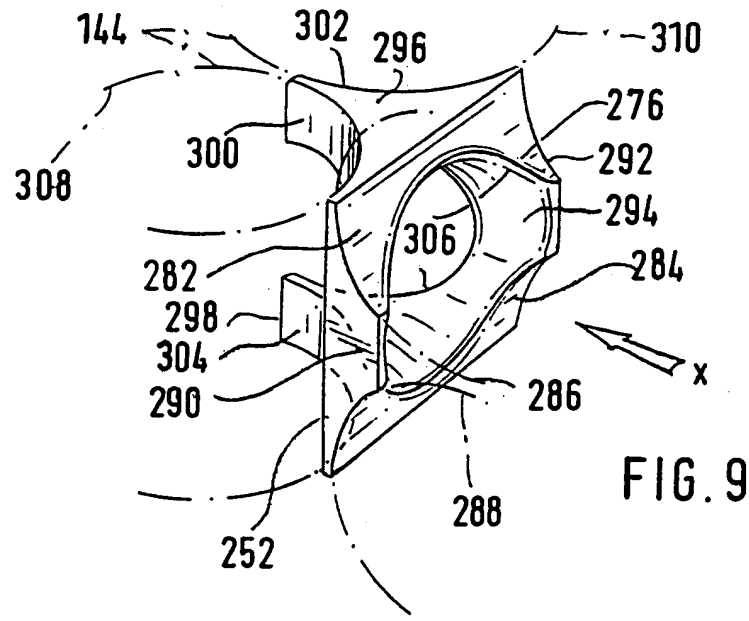
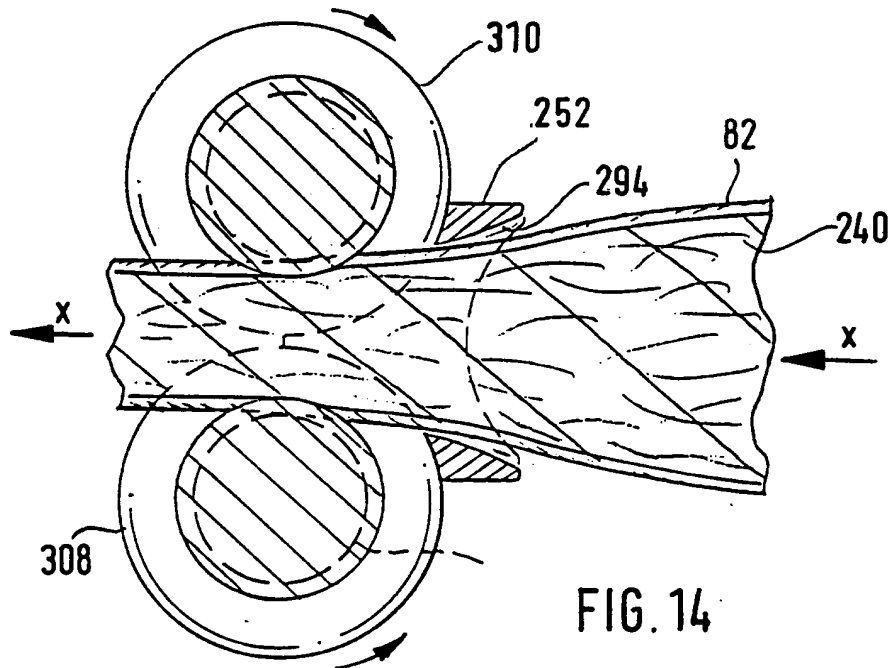
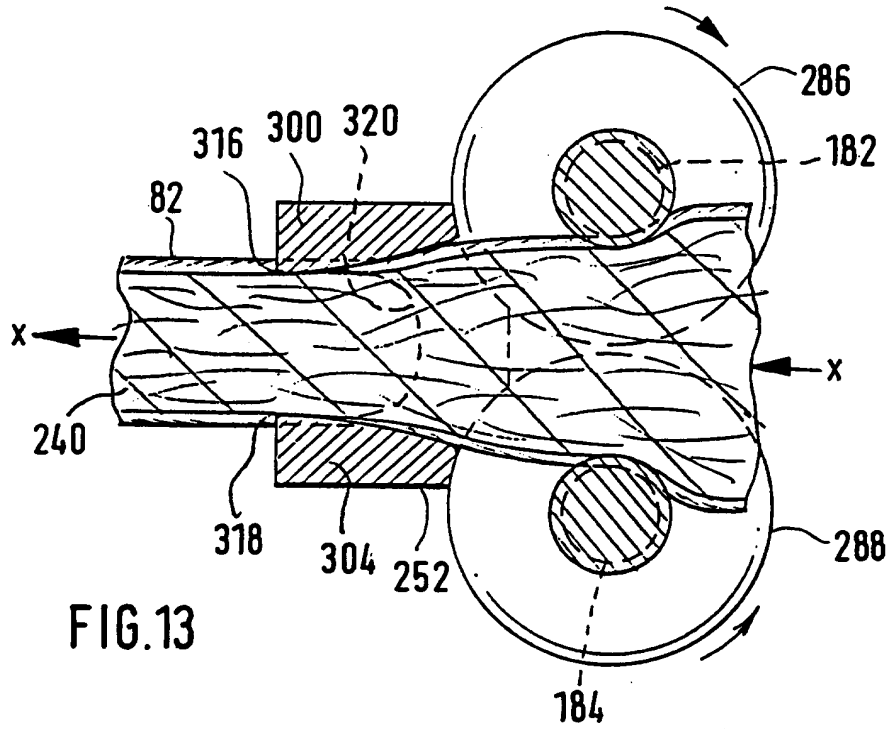


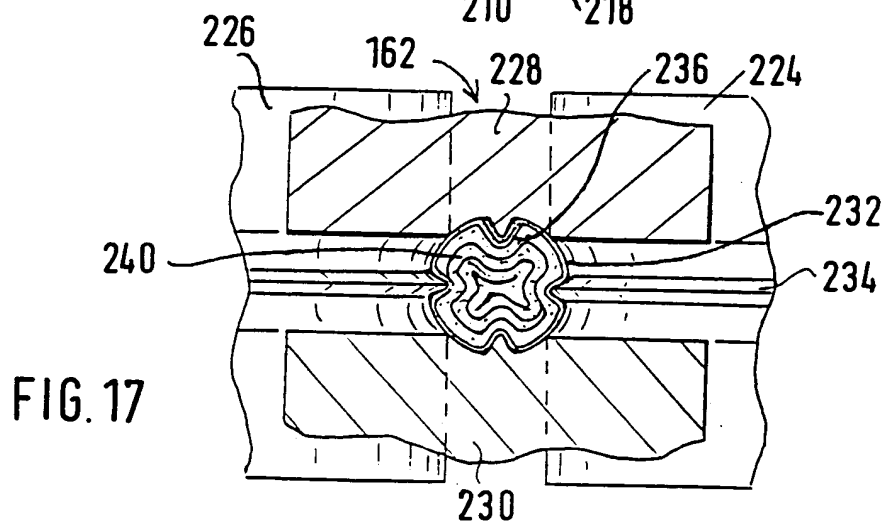
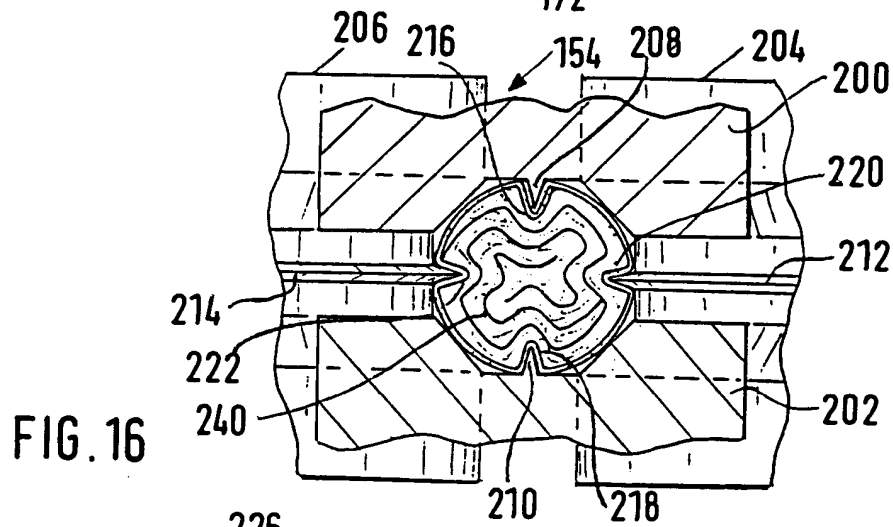
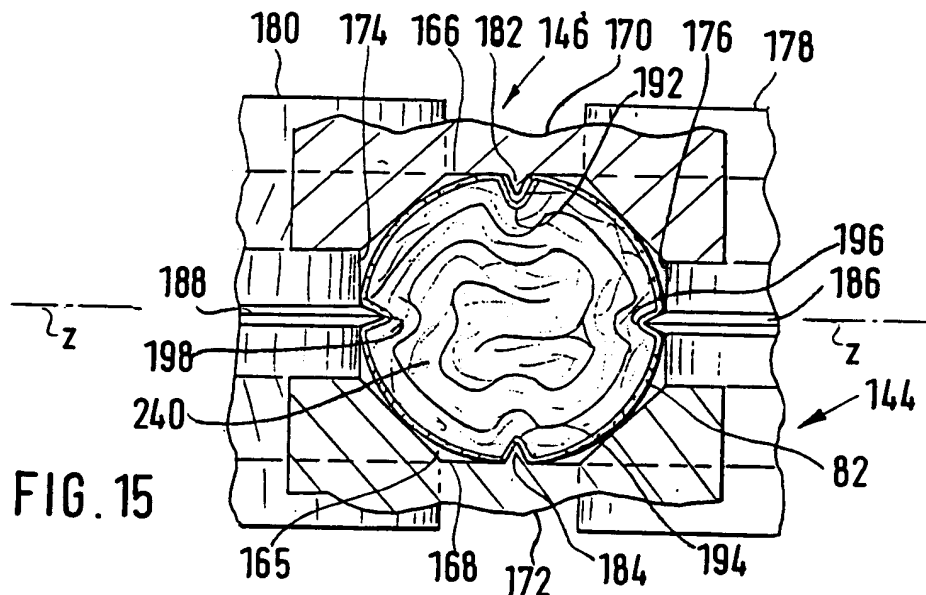
FIG. 7











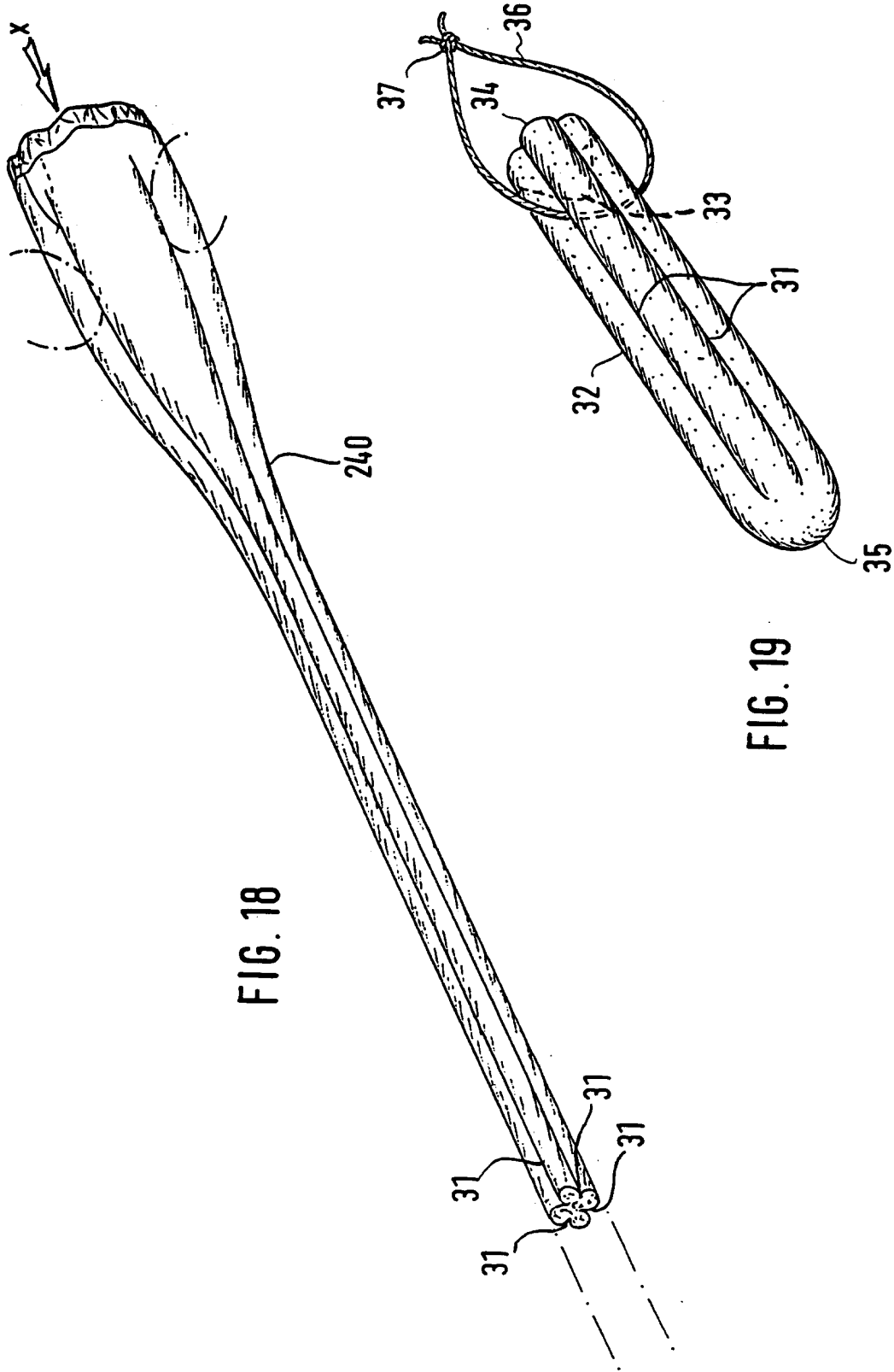


FIG. 18

FIG. 19

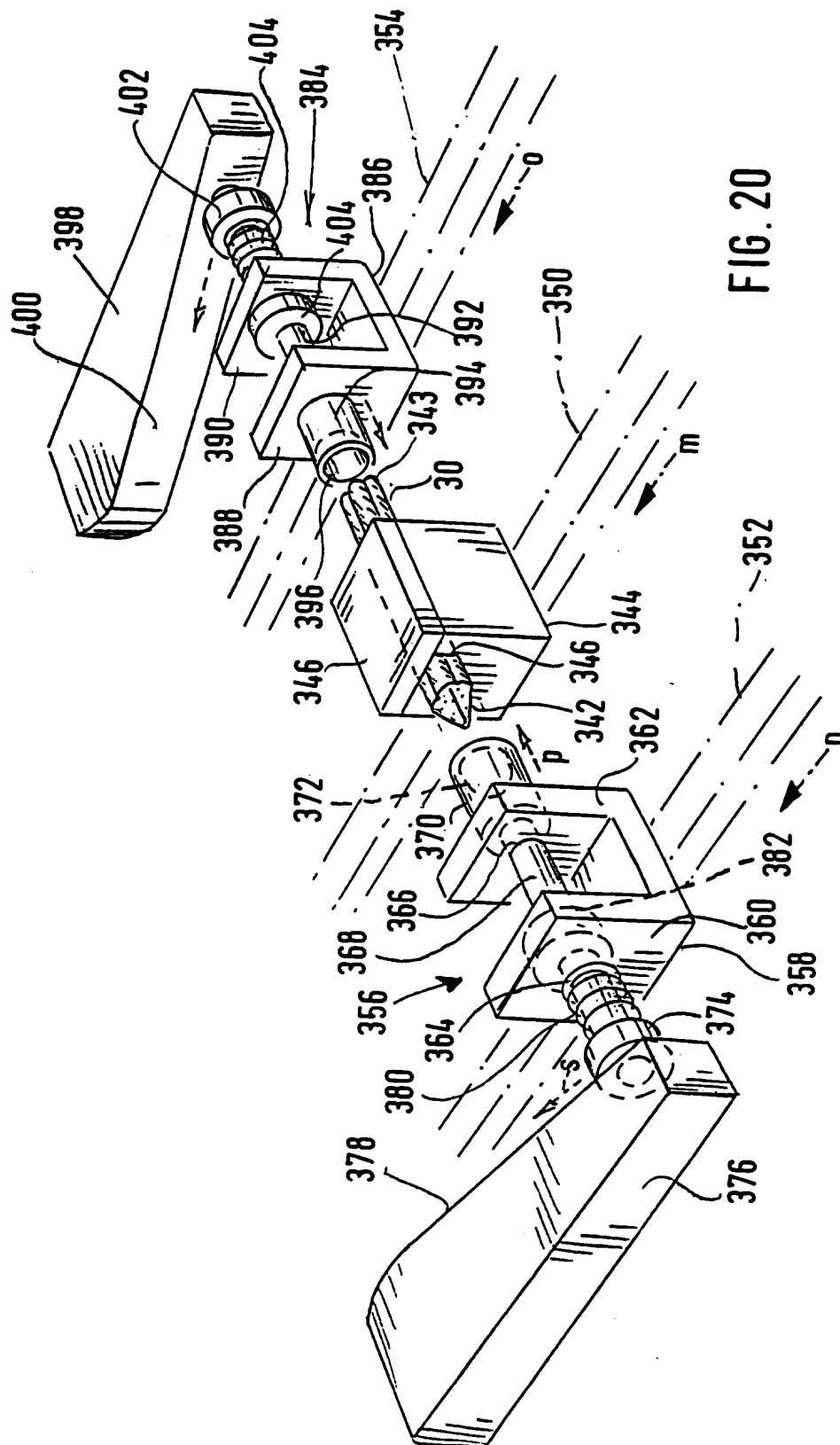


FIG. 20